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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-26423*# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATIONS ON ROLLING DAMPING OF SLENDER WINGS
F. Schlottmann Washington NASA Jun. 1974 22 p refs Transl. into ENGLISH from "Untersuchungen der Rolldampfung von Schlanken Flugeln" Inst. for Thermodyn. and Fluid Dyn., Ruhr Univ., West Ger., Report 71-078, 1971 20 p
(Contract NASw-2481)
(NASA-TT-F-15729; Rept-71-078) Avail: NTIS HC $4.25 CSCL 01A

The aerodynamic forces acting upon slender wing configurations in roll were measured in a low-speed wind tunnel in order to determine the influence of variation of the angle of attack and roll angular velocity. It was shown, for the delta- and square-wing models investigated, that a nonlinear relationship exists between rolling moment and roll angular velocity, and relationship between roll damping and angle of attack. The reason for this is the presence of the leading-edge separation together with the formation of rolled-up vortices over the wing plane. The different vortex configurations and the resulting effects on roll damping are discussed, and compared with the theory.
Author

N74-26424*# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FLUTTER SUPPRESSION AND GUST ALLEVIATION USING ACTIVE CONTROLS Final Report
E. Nissim [1974] 83 p refs
(Grant NGR-52-012-006)
(NASA-CR-138658; TAE-198) Avail: NTIS HC $7.25 CSCL 01A

The effects of active controls on the suppression of flutter and gust alleviation of two different types of subsonic aircraft (the Arava, twin turboprop STOL transport, and the Westwind twin-jet business transport) are investigated. The active controls are introduced in pairs which include, in any chosen wing strip, a leading-edge (LE) control and a trailing-edge (TE) control. Each control surface is allowed to be driven by a combined linear-rotational sensor system, located on the activated strip. The control law, which translates the sensor signals into control surface rotations, is based on the concept of aerodynamic energy. The results indicate the extreme effectiveness of the active systems in controlling flutter. A single system spanning 10% of the wing semispan made the Arava flutter-free, and a similar active system, for the Westwind aircraft, yielded a reduction of 75% in the maximum bending moment of the wing and a reduction of 90% in the acceleration of the cg of the aircraft. Results for simultaneous activation of several LE - TE systems are presented. Further work needed to bring the investigation to completion is also discussed.
Author

N74-26425*# United Aircraft Corp., East Hartford, Conn.
THE PASSAGE OF AN INFINITE SWEPT AIRFOIL THROUGH AN OBLIQUE GUST Final Report
John L. Adamczyk Washington NASA May 1974 96 p refs
(Contract NAS1-11557)
(NASA-CR-2395) Avail: NTIS HC $4.00 CSCL 01B

An approximate solution is reported for the unsteady aerodynamic response of an infinite swept wing encountering a vertical oblique gust in a compressible stream. The approximate expressions are of closed form and do not require excessive computer storage or computation time, and further, they are in good agreement with the results of exact theory. This analysis is used to predict the unsteady aerodynamic response of a helicopter rotor blade encountering the trailing vortex from a previous blade. Significant effects of three dimensionality and compressibility are evident in the results obtained. In addition, an approximate solution for the unsteady aerodynamic forces associated with the pitching or plunging motion of a two dimensional airfoil in a subsonic stream is presented. The mathematical form of this solution approaches the incompressible solution as the Mach number vanishes, the linear transonic solution as the Mach number approaches one, and the solution predicted by piston theory as the reduced frequency becomes large.
Author

N74-26426# Joint Publications Research Service, Arlington, Va.
EFFECT OF PROFILE SHAPE ON AERODYNAMIC CHARACTERISTICS OF A WING NEAR A SHIELD
A. I. Yukhimenko 1 Jul. 1974 11 p refs Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostey (Moscow), no. 2, 1966 p 34-46
(JPRS-62360) Avail: NTIS HC $4.00

The plane problem of the motion of a thin wing with chord $b=2a$ in the potential flow of a fluid at distance h from a solid wall is examined.
Author

N74-26427# Royal Aircraft Establishment, Farnborough (England).
EXPERIMENTAL VERIFICATION OF LIFTING-SURFACE THEORY IN HIGH SUBSONIC FLOW
Roger Destuynder Aug. 1973 16 p Transl. into English from Rech. Aerospatiale (Paris), v. 4, 1972 p 217-224 Presented at Mater. and Struct. Group, AGARD Meeting, Copenhagen, 9-14 Apr. 1972
(RAE-Lib-Trans-1727; BR39067) Avail: NTIS HC $4.00

A series of tests and calculations have been made in order to verify accurately the validity of three-dimensional flutter calculations based on lifting surface theory, and to ascertain whether corrections can be applied using the known values of local unsteady pressures. Pressures have been measured by newly developed wind-tunnel instrumentation. Local pressures, corresponding to pitch motions, were calculated and measured in various cases, and in addition, several flutter configurations,

some of them particularly explosive, were tested, and the results compared with caculations. Satisfactory agreement was found.
Author

N74-26428# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
HIGH SUBSONIC FLOW PAST A STEADY TWO-DIMENSIONAL AEROFOIL
D. Nixon and G. J. Hancock Aeron. Res. Council 1974 40 p refs Supersedes ARC-34260
(ARC-CP-1280; ARC-34260) Avail: NTIS HC $5.00; HMSO 65p; PHI $2.75

The integral equation method for the prediction of the pressure distribution around airfoils in transonic flows was examined with a view to developing a uniform approach to the solution of more general problems in transonic flow, steady or unsteady. The detailed investigation was restricted to the flow around two-dimensional airfoils in steady high subsonic flow. Both lifting and nonlifting airfoils were considered. A simple first approximation to the flow gave a fair degree of accuracy except in the immediate neighborhood of the leading edge. An iterated second approximation gave good results for a NACA 0012 airfoil. Author (ESRO)

N74-26429# Naval Ordnance Lab., White Oak, Md.
HANDBOOK OF BLUNT-BODY AERODYNAMICS, VOLUME 1
John A. Darling 1 Dec. 1973 152 p refs
(AD-776586; NOLTR-73-225-Vol-1) Avail: NTIS CSCL 20/4

This report describes methods for quickly estimating the normal force and center of pressure of blunt free-fall shapes of l/d = 0.5 to 10 over a Mach number range of 0.4 to 2.5 and up to beta = 90 degrees. Charts and equations presented in this report are from cited reference material and original sources. Methods based on slender-body theory were tested on blunt shapes and modifying factors were developed where needed.
Author (GRA)

N74-26430# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
EJECTOR BLOWN LIFT/CRUISE FLAP WIND TUNNEL INVESTIGATION Final Report, Dec. 1971 - May 1973
Rodney L. Clark Nov. 1973 123 p refs
(AF Proj. 1476)
(AD-777181; AFFDL-TR-73-132) Avail: NTIS CSCL 01/3

The report presents the results of a wind tunnel investigation of a two dimensional powered wing section model employing a trailing edge ejector flap as a combination high lift and cruise propulsion device. The concept investigated was proposed for application to STOL aircraft. Thrust augmentation data is presented for the static (zero velocity), Mach .12 and Mach .3 conditions. The compact ejector employed had a nominal inlet area ratio of 5 and produced a peak thrust augmentation ratio of 1.3 under static conditions. The thrust augmentation capability of the ejector decreased rapidly between 0 and Mach .12 to a value of approximately 1.0. Between Mach .12 and .3, the thrust produced by the ejector reduced at a much slower rate. Good high lift performance was obtained with the model in the low speed flight regime. Author (GRA)

N74-27282* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERSPECTIVES IN AEROELASTICITY
I. E. Garrick *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 1-74 refs Presented at 14th Israel Ann. Conf. on Aviation and Astronautics, Tel Aviv, Israel, 1-2 Mar. 1972 Submitted for publication (For availability see N74-27281 16-28)

N74-27288 Pratt and Whitney Aircraft, East Hartford, Conn.
SUPERSONIC UNSTALLED TORSIONAL FLUTTER
L. E. Snyder *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 164-195 refs (For availability see N74-27281 16-28)

N74-27290 Stevens Inst. of Tech., Hoboken, N.J.
SEMIEMPIRICAL ANALYSIS OF STALL FLUTTER
F. Sisto and P. V. K. Perumal *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 215-237 refs (For availability see N74-27281 16-28)
(Contract N00014-67-A-0202-0016)

N74-27291 United Aircraft Corp., East Hartford, Conn.
FLUTTER OF CYLINDRICAL SHELLS EXPOSED TO A SWIRL TYPE OF FLOW
A. V. Srinivasan *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 238-246 (For availability see N74-27281 16-28)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-26431 West Virginia Univ., Morgantown.
NON-LINEAR HELICOPTER ROTOR LIFTING SURFACE THEORY Ph.D. Thesis
Thomas Anthony Csencsitz 1973 342 p
Avail: Univ. Microfilms Order No. 74-11389

A numerical method is developed based on potential flow non-linear lifting surface theory for predicting the surface velocities and pressures on a rotor blade of an arbitrary helicopter rotor system which is executing a constant rotatory and constant axial translatory motion including, specifically, the hover flight mode. The formulation of the problem is exact in the sense that the normal surface boundary condition is satisfied on the surface of the rotor blade. The problem is governed by a Fredholm integral equation of the first kind which relates a singular velocity doublet potential surface distribution applied on the rotor blades and wakes to the normal relative velocity on the rotor blade surface. The wake model is assumed to be of a prescribed shape.
Dissert. Abstr.

N74-26432 Stanford Univ., Calif.
AUTOMATIC TRANSITIONS OF A TILT-ROTOR AIRCRAFT, PART 1. AUTOMATIC CONTROL OF A HELICOPTER WITH A HANGING LOAD, PART 2 Ph.D. Thesis
Narendra Kumar Gupta 1974 205 p
Avail: Univ. Microfilms Order No. 74-13633

Guidance and control of tilt rotor VTOL aircraft and of helicopters with hanging loads are studied. A mathematical model is developed to describe the motions of tilt rotor VTOL aircraft during hover, transition and cruise. This nonlinear model is used to generate satisfactory nominal take-off and landing trajectories. A perturbation guidance technique is then used; the equations of motion are linearized around the nominal trajectories and feedback laws are developed on the deviation of the aircraft states from these nominal values. An autopilot logic is designed for controlling a helicopter with a hanging load. The Sikorsky S-61 helicopter is chosen as an example vehicle. The performance of the controlled system is studied in the presence of longitudinal and lateral winds. Satisfactory response is obtained under design conditions and also with nominal changes in system parameters and configuration. Dissert. Abstr.

N74-26433*# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
RESEARCH OF THE SONIC-BOOM PROBLEM Final Technical Report
Georg Drougge 1973 6 p refs
(Grant NGR-52-120-001)
(NASA-CR-138666; AU-621) Avail: NTIS HC $4.00 CSCL 01B

Wind tunnel tests were conducted to determine the characteristics of sonic booms. A theoretical examination of nonlinear effects in near and far flow fields, as well as sonic boom shock strength, is reported. A study of the Mach lines and bicharacteristics in three dimensional flow was pursued. The direction derivatives if the bicharacteristics were calculated in a general

three dimensional flow field. A second order theory for supersonic flow past slender bodies was developed. Formulas relating flow deflections to the Whitham F-function were derived, which permitted determination of the sonic boom strength from wind tunnel measurements fairly close to the body. Author

N74-26434*# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. Dept. of Aerospace and Environmental Medicine.

AN ANALYSIS OF PILOT ERROR-RELATED AIRCRAFT ACCIDENTS Final Report

Nestor B. Kowalsky, Richard L. Masters, Richard B. Stone, Gary L. Babcock, and Eugene W. Rypka Washington NASA Jun. 1974 79 p refs

(Contract NAS4-1931)

(NASA-CR-2444; H-827) Avail: NTIS HC $4.00 CSCL 01B

A multidisciplinary team approach to pilot error-related U.S. air carrier jet aircraft accident investigation records successfully reclaimed hidden human error information not shown in statistical studies. New analytic techniques were developed and applied to the data to discover and identify multiple elements of commonality and shared characteristics within this group of accidents. Three techniques of analysis were used: Critical element analysis, which demonstrated the importance of a subjective qualitative approach to raw accident data and surfaced information heretofore unavailable. Cluster analysis, which was an exploratory research tool that will lead to increased understanding and improved organization of facts, the discovery of new meaning in large data sets, and the generation of explanatory hypotheses. Pattern recognition, by which accidents can be categorized by pattern conformity after critical element identification by cluster analysis. Author

N74-26435*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY PERFORMANCE APPRAISAL OF NAVY V/STOL TRANSPORT AND SEARCH-TYPE AIRPLANES USING HYDROGEN FUEL

W. C. Strack May 1974 33 p refs

(NASA-TM-X-71550; E-7962) Avail: NTIS HC $3.25 CSCL 01C

First-cut estimates are given of the performance advantages of liquid-hydrogen-fueled, ejector wing, V/STOL aircraft designed for shipboard delivery and search-type missions. Results indicate that the use of LH2 could reduce gross weights 30 percent, empty weights 15 percent, and energy consumption 10 percent for a fixed payload and mission. If gross weight is fixed, the delivery range could be increased about 60 percent or the hover time during a search mission doubled. No analysis or discussion of the economic and operational disadvantages is presented. Author

N74-26436*# Boeing Commercial Airplane Co., Seattle, Wash.

THE 727/JT8D REFAN SIDE NACELLE AIRLOADS

R. W. Bailey and H. J. Vadset Mar. 1974 263 p refs

(Contract NAS3-17842)

(NASA-CR-134547; D6-41527) Avail: NTIS HC $16.25 CSCL 01B

Airloads on the 727/JT8D refan side engine nacelle are presented. These consist of surface static pressure distributions from two low speed wind tunnel tests. External nacelle surface pressures are from testing of a flow-through, body mounted nacelle model, and internal inlet surface pressures are from performance testing of a forced air inlet model. The method for obtaining critical airloads on nacelle components and a representative example are discussed. Author

N74-26437*# Scientific Translation Service, Santa Barbara, Calif.

PROBLEMS INVOLVED IN DEVELOPING AN INTEGRATED FLIGHT CONTROL SYSTEM WITH EMPHASIS ON CURVED FLIGHT PATH PROFILES

H. Boehret Washington NASA 14 Jun. 1974 27 p refs Transl. into ENGLISH of "Realisierungsprobleme eines integrierten Flugregelungssystems unter besonderer Beruecksichtigung gekruemmter Flugbahnprofile", DGLR-Paper-73-03-0, presented at Symp. on New Approach and Landing Tech., Duesseldorf, 2-4 May 1973

(Contract NASw-2483)

(NASA-TT-F-15611; DGLR-Paper-73-030) Avail: NTIS HC $3.50 CSCL 01B

The integrated flight control system FRG 70, based on the theory of complete state feedback, provides for the requisite passenger comfort and control characteristics. It is superior to conventional flight controllers (autopilot and thrust controller), especially during steep approaches. The design principles, operating characteristics, application to direct lift control (DLC), and requisite pilot displays are described. Author

N74-26438# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: WORLD AIRWAYS, INCORPORATED, DC-8-63F, N802WA, KING COVE, ALASKA, 8 SEPTEMBER 1973

8 May 1974 30 p

(NTSB-AAR-74-6) Avail: NTIS HC $4.50

A DC-8 aircraft crashed into Mount Dutton, Alaska with total loss of life of six occupants. The aircraft had been cleared to land at Cold Bay airport while approximately 125 miles east of the airport. The crash occurred approximately 15 miles from the airport. The probable cause was deviation from approved instrument approach procedures and descent into an area of unreliable navigation signals and obstructing terrain. Author

N74-26439# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: PIEDMONT AIRLINES, BOEING 737, N75IN, GREENSBORO, NORTH CAROLINA, 28 OCTOBER 1973

22 May 1974 19 p

(NTJB-AAR-74-7) Avail: NTIS HC $4.00

A Boeing 737 aircraft ran off the runway following a successful instrument landing approach and touchdown. The touchdown was 2,600 feet beyond the approach end of the runway and the airspeed was excessive at touchdown. It was determined that the cause of the accident was ineffective braking action due to hydroplaning on a wet runway. Contributing factors were: (1) an unstabilized downwind approach, (2) relatively long, fast touchdown on a downsloping runway, (3) delayed deployment of the automatic spoilers, and (4) failure of the crew to deploy the spoilers manually. Author

N74-26440# National Aerospace Lab., Tokyo (Japan).

SHEAR AND MOMENT RESPONSE OF THE AIRPLANE WING TO NONSTATIONARY TURBULENCE

Yoshinori Fujimori 14 May 1974 38 p refs Backup document for AIAA synoptic scheduled for publication in AIAA journal, Nov. 1974

Avail: NTIS HC $5.00

A response formulation for the shear force and bending moment of an airplane wing has been established in terms of an evolutionary cross spectrum. Frequency distribution of the responses of arbitrary wing sections are obtained at any time after the airplane enters the nonstationary atmospheric turbulence. Contribution by the pitching motion is the highest to both shear and moment responses. The effect of the shear force to the stress level is negligibly smaller than that due to the bending moment. When the envelope profile looks like a step function, the mean square moment reaches the maximum in the transient stage whose spectrum is dominated by rigid modes. But the spectrum at stationary state, shows both rigid and flexible motions. Author

N74-26441# Joint Publications Research Service, Arlington, Va.

WING OF ARBITRARY ASPECT RATIO NEAR A BARRIER

A. N. Panchenkov and A. I. Yukhimenko 3 Jul. 1974 10 p refs Transl. into ENGLISH from Gidrodinamika Nesushchikh Poverkhn. (Moscow), 1966 p 150-159

(JPRS-62385) Avail: NTIS HC $4.00

A solution of the integral equation for a wing traveling near a barrier is reported. Assumptions that correspond to the Prandtl and Jones theories are introduced to facilitate the solution. The Leydlo approximation for wings of arbitrary aspect ratio is also used. Author

N74-26442# Joint Publications Research Service, Arlington, Va.
THE PROBLEM OF UNSTEADY MOTION OF A WING WITH VARIABLE DISTANCE FROM A BARRIER
A. N. Panchenkov 27 Jun. 1974 18 p ref Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostey (Moscow), no. 2, 1966 p 7-24
(JPRS-62347) Avail: NTIS HC $4.00

The motion of a wing with a variable distance from a barrier is discussed. Both plane and three dimensional cases are examined and calculations for linear dependence of distance in time are performed. Author

N74-26443*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL FREE-FLIGHT INVESTIGATION OF A MODEL OF A SPIN-RESISTANT FIGHTER CONFIGURATION
Sue B. Grafton, Joseph R. Chambers, and Paul L. Coe, Jr. Washington Jun. 1974 76 p refs
(NASA-TN-D-7716; L-9681) Avail: NTIS HC $4.00 CSCL 01C

An investigation was conducted to provide some insight into the features affecting the high-angle-of-attack characteristics of a high-performance twin-engine fighter airplane which in operation has exhibited excellent stall characteristics with a general resistance to spinning. Various techniques employed in the study included wind-tunnel free-flight tests, flow-visualization tests, static force tests, and dynamic (forced-oscillation) tests. In addition to tests conducted on the basic configuration tests were made with the wing planform and the fuselage nose modified. The results of the study showed that the model exhibited good dynamic stability characteristics at angles of attack well beyond that for wing stall. The directional stability of the model was provided by the vertical tail at low and moderate angles of attack and by the fuselage forebody at high angles of attack. The wing planform was found to have little effect on the stability characteristics at high angles of attack. The tests also showed that although the fuselage forebody produced beneficial contributions to static directional stability at high angles of attack, it also produced unstable values of damping in yaw. Nose strakes located in a position which eliminated the beneficial nose contributions produced a severe directional divergence. Author

N74-26444*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISONS OF TWO-DIMENSIONAL SHOCK-EXPANSION THEORY WITH EXPERIMENTAL AERODYNAMIC DATA FOR DELTA-PLANFORM WINGS AT HIGH SUPERSONIC SPEEDS
Lloyd S. Jernell Washington Jun. 1974 36 p refs
(NASA-TN-D-7583; L-9316) Avail: NTIS HC $3.25 CSCL 01B

An investigation has been conducted to explore the potential for optimizing airfoil shape at high supersonic speeds by utilizing the two-dimensional shock-expansion method. Theoretical and experimental force and moment coefficients are compared for four delta-planform semispan wings having a leading-edge sweep angle of 65 deg and incorporating modified diamond airfoils with a thickness-chord ratio of 0.06. The wings differ only in airfoil maximum-thickness position and camber. The experimental data are obtained at Mach numbers of 3.95 and 4.63 and at a Reynolds number of 9.84 million per meter. A relatively simple method is developed for predicting, in terms of lift-drag ratio, the optimum modified diamond airfoil at high supersonic and hypersonic speeds. Author

N74-26445# Advisory Group for Aerospace Research and Development, Paris (France).
PREDICTION METHODS FOR AIRCRAFT AERODYNAMIC CHARACTERISTICS
May 1974 349 p refs
(AGARD-LS-67) Avail: NTIS HC $20.50

The proceedings of a conference on methods of predicting aircraft performance are presented. Emphasis was placed on predicting aircraft range and radius, airfield and maneuver performance, and aerodynamic characteristics. Combat and transport aircraft were considered over conditions ranging from extremely low speeds through subsonic/transonic to supersonic speeds. Aircraft lift and drag estimation methods were analyzed along with related aerodynamic optimization techniques. Practical methods for wing/body aerodynamic design and boundary layer flow treatments were considered. The prediction and implications of special aerodynamic characteristics associated with engine installation and external store effects are examined, relevant stability/control needs are reviewed, and some aircraft noise restraints on aerodynamic design are investigated. For individual titles, see N74-26446 through N74-26455.

N74-26446 Royal Aircraft Establishment, Farnborough (England).
GENERAL TECHNICAL INFORMATION
John Williams *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 5 p (For availability see N74-26445 16-02)

Prediction and optimization methods for determining aircraft performance are discussed. The major deficiencies in the state of knowledge on aerodynamic characteristics are assessed. Recommendations for improvement in theoretical treatments, ground based testing facilities, and flight testing techniques are submitted. The overall technical constraints on aircraft performance prediction are defined. Specific technical lectures on the subjects of aircraft performance, wing aerodynamic design, engine installation aerodynamics, external store aerodynamics, and stability and control implications are identified. Author

N74-26447 McDonnell-Douglas Corp., Long Beach, Calif. Aerodynamics Subdivision.
AERODYNAMIC PREDICTION METHODS FOR AIRCRAFT AT LOW SPEEDS WITH MECHANICAL HIGH LIFT DEVICES
J. G. Callaghan *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 52 p refs (For availability see N74-26445 16-02)

A survey of present methodology used for the estimation of low speed aerodynamic characteristics of aircraft with mechanical high lift systems is presented. While this methodology is applicable to a large variety of aircraft with unpowered high lift systems, the emphasis is on transport type aircraft. Prediction methods empirically derived from experimental data, as well as more sophisticated theoretical methods are discussed. Correlations of calculated results with both wind tunnel and flight measurements are presented. To place the current state of the art of methodology into proper perspective, a critical review of areas of both strength and weakness is presented, with emphasis on future requirements. Within this context, the particular need for methods to estimate the high lift characteristics of aircraft with thin, highly swept, low aspect ratio wings, such as supersonic transport configurations are reviewed. Author

N74-26448 Royal Aircraft Establishment, Bedford (England).
A REVIEW OF THE LOW SPEED AERODYNAMIC CHARACTERISTICS OF AIRCRAFT WITH POWERED LIFT SYSTEMS
D. N. Foster *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 43 p refs (For availability see N74-26445 16-02)

The aerodynamic characteristics of a number of different configurations of fixed-wing aircraft with powered lift systems are discussed. Methods for predicting the aerodynamic characteristics are developed. Consideration is given to aircraft employing boundary layer control, based on jet flaps with internal blowing, external blowing from underwing and overwing engines, and augmentor systems. Spanwise blowing and other specialized techniques are examined. Aerodynamic characteristics in ground effect, as well as in free air, are reported. Some aspects of the noise problems which are directly related to the particular lowered lift system under discussion are considered. Author

N74-26449 Boeing Commerical Airplane Co., Renton, Wash.
AIRCRAFT LIFT AND DRAG PREDICTION AND MEASUREMENT
G. M. Bowes *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 44 p refs (For availability see N74-26445 16-02)

Techniques for predicting and measuring lift and drag relationships for subsonic cruise flight are described. The status

of this drag methodology is reviewed. Recent presentations on the subject are referenced and incorporated into an overall summary describing current capabilities for developing the basis of aircraft performance predictions. The role of the wind tunnel in airplane design and development is discussed, and the importance of flight test measurements of specific range and engine parameters is emphasized. Theoretical developments for three-dimensional design and lift/drag predictions are described. The accuracy with which the drag levels of a new design can be determined is examined. Examples of specialized wind tunnel and flight investigations into the airflow and pressures on localized portions of an airplane are presented. Author

N74-26450 British Aircraft Corp., Filton (England).
PREDICTION OF SUPERSONIC AIRCRAFT AERODYNAMIC CHARACTERISTICS
C. S. Leyman and T. Markham *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 52 p refs (For availability see N74-26445 16-02)

The methods currently available for the prediction of the aerodynamic characteristics of supersonic aircraft as they effect performance are reviewed. The problems of supersonic aircraft design are illustrated by consideration of hypothetical transport and flighter aircraft. The methods used to predict the performance of the Concorde aircraft are stressed. The aerodynamic principles which make supersonic aircraft different from subsonic designs are analyzed. The accuracy and suitability of design methods for various stages of design are examined. The state of the art for estimating parisitic drag and thrust loss due to air leakage is described. Problems of estimating the installed powerplant performance are included. Author

N74-26451 National Aerospace Lab., Amsterdam (Netherlands).
APPRAISAL OF WING AERODYNAMIC DESIGN METHODS FOR SUBSONIC FLIGHT SPEED
W. Loeve *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 41 p refs (For availability see N74-26445 16-02)

For a number of direct calculation methods for the prediction of flows around wings at subsonic speed, the basic assumptions are discussed. This forms the basis for the applicability of the methods. Comparison of calculated pressure distributions with results from wind-tunnel tests serve to illustrate this for three-dimensional wings and for the limiting case of plane flows around airfoils. Attention is paid to the use of inverse methods. In this context the use of hodograph methods for the design of aerofoils with transonic shockfree flow is discussed. Author

N74-26452 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
BOUNDARY LAYER CALCULATION METHODS AND APPLICATION TO AERODYNAMIC PROBLEMS c12
J. Steinheuer *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 48 p refs (For availability see N74-26445 16-02)

Methods for analyzing boundary layer flow characteristics and application to predicting aircraft performance are discussed. Mathematical models for a steady two-dimensional incompressible boundary layer are developed. The structures of the various types of boundary layers are analyzed. Tables of data are included to show the numerical solution of partial differential equations for different flow conditions. Examples of boundary layer calculations are included for cases of compressible boundary layers, three dimensional boundary layers, and turbulent boundary layers. Airfoils are examined for conditions of attached flow over a single airfoil, attached flow over an airfoil with a slotted flap, and airfoil flow with separation. Methods for predicting buffet boundaries for a wing in transonic flow are reported. Author

N74-26453 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ENGINE INSTALLATION AERODYNAMICS
J. Leynaert *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 22 p refs (For availability see N74-26445 16-02)

Aspects of engine installation aerodynamics are considered to include theoretical design, optimization of the engine installation, and experimental study. Air intake, afterbody, and engine/aircraft integration problems are analyzed for high subsonic and supersonic aircraft. High speed and low speed performance are discussed. Comments are made on variable geometry devices. Special attention is given to the significance of the various propulsion and drag balance terms. Author

N74-26454 Aircraft Research Association, Ltd., Bedford (England).
EXTERNAL STORE AERODYNAMICS FOR AIRCRAFT PERFORMANCE PREDICTION
J. B. Berry *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 34 p refs (For availability see N74-26445 16-02)

Some effects of external stores on the aerodynamic characteristics of aircraft and in particular the incremental drag due to various types of store installation are described. Examples of drag increments for single and multiple store assemblies installed underwing and underfuselage and the effects of C sub L and Mach number up to high subsonic speeds, illustrate some of the interference features in the aircraft-store flow field which contribute to high or low drag. The prospects for incremental drag prediction, the possible use of calculated or measured flow field data, empirical methods and flight-tunnel comparisons are discussed. Approximate empirical estimation procedures for simple underwing and underfuselage store installations are described. It is suggested that for multiple store assemblies, opportunities for drag reduction offer considerably more promise than attempts to predict the drag increment. Significant drag savings are demonstrated not only for new types of installation but also by relatively simple modifications to existing designs. Author

N74-26455 Royal Aircraft Establishment, Farnborough (England).
SUPPLEMENTARY CONTRIBUTION ON AIRCRAFT PERFORMANCE CONSIDERATIONS FOR NOISE REDUCTION
John Williams *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 1 p (For availability see N74-26445 16-02)

The problem of achieving much lower noise levels outside airport boundaries, while at the same time predicting and quaranteeing the noise field from future aircraft with greater accuracy, is examined. Methods for obtaining reductions in aircraft noise levels are identified. The integration of aircraft performance characteristics, airframe design, and airframe-engine aero-acoustic intereference parameters to produce reduced noise levels is emphasized. Author

N74-26456*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WINGTIP VORTEX DISSIPATOR FOR AIRCRAFT Patent Application
James C. Patterson, Jr., inventor (to NASA) Issued 24 May 1974 12 p
(NASA-Case-LAR-11645-1; US-Patent-Appl-SN-473973) Avail: NTIS HC $4.00 CSCL 01C

An apparatus for reducing the effects of aircraft wingtip vortices is discussed. The device consists of a spline structure containing hinged and retractable flat plates which create a positive pressure gradient in the area downstream of the wing trailing edge. This positive pressure gradient causes the vortex to dissipate by forcing the linear air flow around and through the core of the vortex. Alternate configurations in the form of a drag chute or a wingtip mounted engine are considered. NASA

N74-26457*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW SPEED WIND TUNNEL TESTS OF A 1/9-SCALE MODEL OF A VARIABLE-SWEEP ADVANCED SUPERSONIC TRANSPORT An Early Domestic Dissemination Report
H. Clyde McLemore, Lysle P. Parlett, and William G. Sewall May 1974 84 p refs
(NASA-TM-X-71960) Avail: NASA Regional Dissemination Centers only to U.S. Requesters: HC $4.00/MF $1.45 CSCL 01C

Tests have been conducted in the Langley full-scale tunnel to determine the aerodynamic characteristics of a 1/9-scale variable-sweep advanced supersonic transport configuration. The model configurations investigated were the basic unflapped

arrangement, and a takeoff and landing flap arrangement with several strake leading edge flow control devices. The tests were conducted for an angle-of-attack range from about minus 5 deg to 36 deg and a sideslip range from minus 5 deg to 10 deg. The tests were conducted for a range of Reynolds number from 3.92 million to 5.95 million corresponding to test velocities of about 54.5 knots and 81.7 knots, respectively. Author

N74-26458# Royal Aircraft Establishment, Farnborough (England).
FAIL-SAFE AIRCRAFT STRUCTURES, VOLUME 1
A. M. Stagg, comp. Mar. 1974 363 p refs Proc. of the 7th Intern. Comm. on Aeron. Fatigue Symp., London, 18-20 Jul. 1973 2 Vol.
(RAE-TR-73183-Vol-1; BR39889) Avail: NTIS HC $21/25

Among the topics covered are: fatigue life of aircraft structures under loads; fatigue and failure procedures and programs; fail-safe and airworthiness philosophy; and fatigue crack propagation. For vol. 2, See N74-26468. For individual titles, see N74-26459 through N74-26467.

N74-26459 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE LIFE OF STRUCTURAL COMPONENTS UNDER RANDOM LOADING **c32**
E. Gassner *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 35 p refs (For availability see N74-26458 16-02)
(LBF-FB-107/1973)

Experimental methods available for evaluating the fatigue strength of engineering materials and for defining the fatigue life of structures subjected to random loading are considered. These range from constant amplitude tests to tests in which both the amplitudes and the frequencies occurring under service conditions are duplicated. Selection of a test method is guided by considerations as to whether or not service loading is realistically simulated or at least tolerably simplified. This raises problems which cannot be resolved, even with the most sophisticated testing equipment available, without making compromises with regard to test duration, cost and, comparability of test results. A standard procedure based on extensive experience and on relevant literature is proposed which, it is hoped, will contribute to an improvement of the state of knowledge in most area concerned with fatigue life prediction. Author (ESRO)

N74-26460 Royal Aircraft Establishment, Farnborough (England).
FAIL-SAFE PHILOSOPHY: AN INTRODUCTION TO THE SYMPOSIUM
R. D. J. Maxwell *In its* Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 13 p refs (For availability see N74-26458 16-02)

The current approach to the fail-safe philosophy of design against fatigue is examined. The general principles to be followed, are stated, and some of the problems involved, both in writing requirements that adhere to the stated principles and in interpreting those requirements, are assessed. Some of the potential dangers that have developed in the application of the fail-safe approach over the years are also considered.
Author (ESRO)

N74-26461 Societe Nationale Industrielle Aerospatiale, Paris (France).
INTERRELATED ASPECTS OF SERVICE SAFETY ARISING FROM CONSIDERATION OF SAFE LIFE, FAIL-SAFE, MANUFACTURING QUALITY AND MAINTENANCE PROCEDURES
W. G. Barrois *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 44 p refs (For availability see N74-26458 16-02)

An attempt is made to determine whether a quantitative appraisal may be achieved concerning safe-life and fail-safe characteristics of aircraft structures. The conclusion reached is somewhat negative: substantiation of safe-life, fail-safe or of both safe-life and fail-safe, does not always give sufficient levels of safety. It must be combined with levels of manufacturing quality and of inspection efficiency, which are all the higher as the fatigue stressing is higher. Remedies against fatigue and other causes of damage are not to be found by consideration of a single concept but may be obtained by considering a combination of concepts, taking into consideration their effects on safety, weight, and cost. Safety ensured by fail-safe alone would entail unacceptable weight penalization when applied to the whole structure. Real fail-safe is not always realizable. On the other hand, a general high level of manufacturing quality may be very expensive to achieve and may induce catastrophic failure in cases in which the quality is jeopardized by an undetected defect. Frequent, scheduled inspections may be costly and may even become illusory owing to the repeated observation of no damage. Author (ESRO)

N74-26462 Lockheed-California Co., Burbank.
THE LOCKHEED L-1011 TRISTAR FATIGUE AND FAIL-SAFE DEVELOPMENT PROGRAM
L. W. Nelson, M. A. Melcon, and H. Simons *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 115 p refs (For availability see N74-26458 16-02)

The various tests performed on the Lockheed L-1011 are described. The elements of the program included formulation of criteria, analysis, development tests, component design verification tests, and fatigue and fail-safe tests on two separate airframes.
Author (ESRO)

N74-26463 Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
INVESTIGATION OF THE FAIL-SAFE PROPERTIES OF CIVIL AIRCRAFT
G. J. Fonk *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 27 p (For availability see N74-26458 16-02)

Current fail-safe methods are discussed with respect to inspection, crack growth, and residual strength. Attention is paid to the variety of components to be considered, testing procedures, and interpretation of the results. Emphasis is placed on the basic ideas, which are illustrated by procedures adopted for the F-28 aircraft. Author (ESRO)

N74-26464 McDonnell-Douglas Corp., Long Beach, Calif.
AIRWORTHINESS PHILOSOPHY DEVELOPED FROM FULL-SCALE TESTING
M. Stone *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 40 p refs (For availability see N74-26458 16-02)

Results derived from full-scale repeated load tests are presented to aid in the development of airworthiness philosophy. Information is considered on testing philosophy, test spectrum, crack-free structure, crack growth, residual strength, and inspection programs. The test spectrum is derived from analysis spectra and is strongly influenced by economic and schedule considerations. A large number of low loads and infrequent high loads which do not contribute any substantial amount of damage are excluded. Testing to two lifetimes and finding relatively few cracks proved the long-term reliability of the DC 10 structure. The few places requiring design improvements, as expected in any fatigue tests, are described and the scatter of fatigue lives caused by variability of interference fit fasteners is evaluated. The inspection program developed for the DC 10 structure is discussed in conjunction with the full scale fatigue test results. The evaluation of these fatigue tests considers the scatter factor in relation to expected service experience. An understanding of the inspection objectives is required in order to minimize cost and delay in schedules.
Author (ESRO)

N74-26465* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A UNIFIED TECHNOLOGY PLAN FOR FATIGUE AND FRACTURE DESIGN
H. F. Hardrath *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 22 p refs (For availability see N74-26458 16-02)

An integrated research program is proposed that seeks to improve the technology of designing against fatigue and fracture and to develop a computerized capability for assessing the adequacy of a given design. Both fatigue life prediction and damage tolerance considerations are incorporated. The research for each of these considerations is organized to account for material behavior, the effect of structural configurations, the cumulative effects of the operating loadings, and the effects of temperature and corrosion. Author (ESRO)

N74-26466 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).

EFFECT OF MEAN STRESS ON CRACK PROPAGATION UNDER RANDOM LOADING c32

H. Nowack and B. Mukherjee *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 29 p refs (For availability see N74-26458 16-02)

Avail: NTIS

The effect of mean stress on crack propagation behavior under random loading, which approximately follows the conditions of a stationary Gaussian process, was investigated. The RMS value of the random loading and the mean stresses were kept constant throughout the tests. It was found that the variation of stresses had very little effect on the cycle numbers to initiate a crack of a given length but a pronounced influence on the life behavior in the crack stage. The Roberts and Erdogan crack propagation equation for single level loading was modified to correlate the effect of different mean stresses on crack propagation under random loading. In a second test program, the mean stress was varied between two levels. It was observed that also in this case the initiation was not greatly influenced by the mean stress variations but the crack stage was significantly affected. The crack propagation in the random sequences with the lower mean stress was considerably decelerated compared to the crack propagation behavior observed with constant mean stresses throughout the tests. An explanation of the observed sequence effects is given on the basis of the crack closure considerations as suggested by Elber and others. Author (ESRO)

N74-26467 National Aerospace Lab., Amsterdam (Netherlands).

THE PREDICTION OF FATIGUE CRACK PROPAGATION UNDER SERVICE LOAD-TIME HISTORIES

J. Schijve *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 31 p refs (For availability see N74-26458 16-02)

(NLR-MP-73016-U)

Results are presented from crack propagation tests on aluminum alloy sheet specimens tested by flight simulation loading. Five design stress levels were adopted. The usefulness of the stress intensity factor for correlating the data was evaluated. Various approaches for predicting crack rates under service loading, damage calculations, and the significance of flight simulation testing procedures are discussed. Author (ESRO)

N74-26468# Royal Aircraft Establishment, Farnborough (England).

FAIL-SAFE AIRCRAFT STRUCTURES, VOLUME 2

A. M. Stagg, comp. Mar. 1974 379 p refs Proc. of the 7th Intern. Comm. on Aeron. Fatigue Symp., London, 18-20 Jul. 1973 2 Vol.

(RAE-TR-73183-Vol-2; BR39890) Avail: NTIS HC $22.00

Fail-safe methods and fatigue and fracture problems under various conditions are discussed. For Vol. 1, see N74-26458. For individual titles, see N74-26469 through N74-26479.

N74-26469 Societe Nationale Industrielle Aerospatiale, Marignane (France.) Helicopter Div.

INFLUENCE OF THE DEGREE OF FAIL-SAFE ACHIEVED, USING THE INTERNAL PRESSURE INDICATOR (BIM), ON THE FLIGHT SAFETY DURING A SPECIFIED SERVICE LIFE OF MAIN ROTOR BLADES OF SA 321 AND SA 330 HELICOPTERS

F. Liard and C. Marcoux *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 29 p refs (For availability see N74-26468 16-02)

In order to increase the retirement life of hollow helicopter blades, the blades are pressure drop sensed by a pressure blade indicator system (called BIM for blade inspection method) which is inspected before each flight. The increase in retirement life is supported by probability computations based on the crack propagation rate measured during blade fatigue tests.

Author (ESRO)

N74-26470 United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

FATIGUE AND FRACTURE CONSIDERATIONS IN CRITICAL TITANIUM COMPONENTS c32

M. J. Salkind *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 12 p refs (For availability see N74-26468 16-02)

The use of titanium for aircraft structures, because of its fatigue and fracture strength, is discussed. The example given is its use in the H-53 rotor blade which provides a significant increase in lift and speed for the same weight as aluminum.

Author (ESRO)

N74-26471 Oklahoma City Air Materiel Area, Tinker AFB, Okla.

EFFECT OF PROOF LOAD APPLICATION ON FATIGUE TEST RESULTS c32

J. Bell and J. B. Dempster (Boeing Co., Wichita, Kans.) *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 25 p refs (For availability see N74-26468 16-02)

The effect of high loads on fatigue crack initiation and growth was evaluated based on data obtained from two full-scale fatigue tests of generally identical 7178-T6 structures. The flight-by-flight loading spectrum applied during a 1962 fatigue test included a proof load (90 % limit load) once every 200 flights. A 1972 fatigue test with a similar flight-by-flight loading spectrum included only those loads expected in fleet operation. The maximum applied load in the second test was 62% of limit load applied once every 200 flights. Fatigue cracking developed earlier in the 1972 fatigue test than in the 1962 test. Small specimen testing was conducted to confirm and quantify this high load effect. Both test loading spectra were applied to 7178-T6 specimens. Analysis predictions of the specimen test crack propagation were also developed to show the effects of high loads on crack retardation. The full scale fatigue test, specimen fatigue test, and analysis results indicate support of the premise that application of high loads will delay crack initiation and retard crack growth in 7178-T6. Author (ESRO)

N74-26472 Federal Aircraft Establishment, Emmen (Switzerland).

RESIDUAL STRENGTH AT HIGH LOADING RATES OF FATIGUE CRACKED TEST SPECIMENS OF TWO ALUMINIUM ALLOYS AND SOME STEELS c32

J. Branger *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 84 p refs (For availability see N74-26468 16-02)

Existing investigations were grouped to reveal gaps in the present knowledge of the residual strength of light alloys, and some references are reviewed for comparison. Experimental details of the tests carried out, as well as the aim and scope of the investigation, are outlined. Results of previous tests are presented in full, as well as those of the new tests designed to investigate the influence of fatigue cracks, loading rate, and low temperature. It is concluded that all three parameters decrease the residual strength to a different amount for the different alloys. Most alloys exhibit a brittle behavior. Author (ESRO)

N74-26473 Boeing Commercial Airplane Co., Seattle, Wash.

THE 747 FAIL-SAFE STRUCTURAL VERIFICATION PROGRAM

R. V. Sanga *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 66 p refs (For availability see N74-26468 16-02)

The extension of a previously developed analytical approach and development of a finite element technique for the 747 structural development program are described. Subsequent improvements include the fastener flexibility effects on the first fastener load and residual strength response within a simulated elastic-plastic range; scope of the methods for applications to riveted, bonded, and integrally stiffened configurations containing realistic complex damages at fastener locations; comparisons with laboratory component tests; and correlations with the full-scale test configurations. As part of the 747 structural integrity verification, an extensive full-scale fatigue and fail-safe test program was conducted. The basic test approach consisted of subjecting each major structural item to at least one lifetime of fatigue testing. Fail-safe tests were conducted on several test damage configurations, and in all cases fail-safe load was successfully demonstrated. Good correlation was found between test data and calculated stress distributions and residual strengths. Author (ESRO)

N74-26474 Ministry of Defence, London (England).

AIRCRAFT FATIGUE AND STRUCTURAL INTEGRITY IN THE ROYAL AIR FORCE FROM A MAINTENANCE ENGINEERING VIEWPOINT

H. A. Mills and G. D. MacDonald *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 12 p (For availability see N74-26468 16-02)

An indication is given of the military environment and of

the current policy designed to establish a Royal Air Force contribution to the ultimate aim of improving assessment of aircraft structural reliability. Current problems are reviewed against the background of a multirole, mobile force with a wide variety of aircraft types of differing ages and technologies. Emphasis is placed on the ever present need for close cooperation between research, design, operations, and maintenance to achieve peak operating efficiency while preserving structural integrity.
Author (ESRO)

N74-26475 Department of Civil Aviation, Melbourne (Australia).
THE IMPACT OF LONG SERVICE ON THE FATIGUE OF TRANSPORT AIRCRAFT: AIRWORTHINESS ASPECTS
K. R. A. OBrien, C. Torkington, M. B. Benoy, and R. B. Douglas *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 30 p refs (For availability see N74-26468 16-02)

Actual case studies involving fatigue problems in large civil aircraft, which have occurred in Australia in recent years as a result of long service, are discussed. The current design standards covering fatigue evaluation of flight structures are briefly reviewed, and service problems and their effects on fail-safe are discussed. Effects of developments in fracture and fatigue analysis methods are described, and the pressing of aged aircraft into extended service is considered.
Author (ESRO)

N74-26476 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
A STANDARDIZED FLIGHT-BY-FLIGHT TEST PROGRAM FOR THE FATIGUE LIFE EVALUATION OF WING COMPONENTS OF TRANSPORT AIRCRAFT
D. Schuetz *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 34 p (For availability see N74-26468 16-02)

A life calculation for spectra different from the standardized load spectrum is proposed using Miner's rule. Tests were run to check the accuracy of the concept taking into account effective differences between load spectra. It is shown that Miner's rule when applied to this concept does not provide too satisfying results for most of the extreme spectra modifications.
Author (ESRO)

N74-26477 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FULL-SCALE FATIGUE TESTING. A COMPARISON WITH SERVICE EXPERIENCE AND INTERPRETATION OF TEST RESULTS c32
H. J. Zocher *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 35 p refs (For availability see N74-26468 16-02)

The basic requirements which should be met by full-scale fatigue tests for reliable fatigue life predictions are briefly outlined. A comparison of test results obtained from two full scale fatigue tests with different types of loading programs demonstrates that flight-by-flight fatigue tests are superior to block program loading. Flight-by-flight test lives were compared to service experience and showed reasonable agreement. Some conclusions to be drawn from test results are discussed.
Author (ESRO)

N74-26478 Royal Aircraft Establishment, Farnborough (England).
FATIGUE IN CARBON FIBRE REINFORCED PLASTIC STRUCTURES: A REVIEW OF THE PROBLEMS c32
A. W. Cardrick *In its* Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 28 p refs (For availability see N74-26468 16-02)

The properties of carbon fiber reinforced plastics are discussed, and an attempt has been made to anticipate the more important questions which must be answered in order to aid design and the formulation of airworthiness reqirements for fatigue loaded CFRP structures. Programs of fatigue research on carbon fiber reinforced plastics are summarized. Plans are presented for complementary intramural work in which specimens containing typical structural features will be tested under realistic loading.
Author (ESRO)

N74-26479 Westland Helicopters Ltd., Hayes (England).
FATIGUE OF COMPOSITE STRUCTURES: EXPERIENCE GAINED IN THE DESIGN OF CFRP STRUCTURES FOR HELICOPTERS
H. F. Winny *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 20 p refs (For availability see N74-26468 16-02)

Fatigue testing on carbon fiber reinforced plastic (CFRP) components for helicopter structural members is described. It includes fatigue testing on flat laminates in compression, bolted joints in tension and coupon rings in bending. These were planned to give fatigue design data on the actual angled-ply used, as well as overall testing in torsion of completed CFRP shafts, and joint in tension of a 30 in. length of tail boom. The results in general are satisfactory, and certain criteria are suggested for future designs.
Author (ESRO)

N74-26480# Sandia Labs., Albuquerque, N.Mex.
STRAIN MEASUREMENT IN PARACHUTE WEBBING WITH ELASTOMERIC STRAIN GAGES
D. F. McVey 1973 27 p refs Presented at Conf. on Stresses and Strains in Textile Structures, Manchester, Engl., 12 Sep. 1973 Sponsored by AEC
(SLA-73-5764; Conf-730928-1) Avail: NTIS HC $3.50

Results show that the elastomeric strain gage can be used on parachute webbings to obtain static and dynamic strain data up to at least 25% and possibly as high as 30 to 35% elongation. To obtain best accuracy, calibration curves should be developed for each material on which the gage is to be used. Errors in strain reading caused by webbing curvature can be reduced to less than 0.5% if the ratio of the gage length to the radius of the curve is less than 0.15. Initial tests indicate that the gages can withstand the environment encountered during parachute packing and deployment.
Author (NSA)

N74-26481# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
AIRCRAFT NOISE IN URBAN AREAS. MEASUREMENT AND EVALUATION [FLUGLAERM IN WOHNGEBIETEN - MESSUNG UND BEURTEILUNG]
H.-O. Finke and R. Martin 1974 8 p refs In GERMAN Presented at the DGLR Symp. Triebwerkslaerm, Brunswick, 20-21 Feb. 1974
(DGLR-Paper-74-013) Avail: NTIS HC $4.00

Acoustic measurements of aircraft noise in an urban area were made and evaluated. A district of Munich, Germany, with 100,000 inhabitants was the urban area selected. The following measurements were made: maximum aircraft-sound level number, duration and frequency of overflights, and background noise. The evaluations are discussed in detail.
ESRO

N74-26482# Luftfahrt-Bundesamt, Brunswick (West Germany).
NOISE LIMIT VALUES OF AIRCRAFT [LAERMGRENZWERTE BEI LUFTFAHRZEUGEN]
F. K. Franzmeyer 20 Feb. 1974 18 p refs In GERMAN Presented at the DGLR Symp. Triebwerkslaerm, Brunswick, 21 Feb. 1974
(DGLR-Paper-74-015) Avail: NTIS HC $4.00

Aircraft noise threshold values for jet aircraft with a maximum takeoff weight above 5700 kg, propeller aircraft with a maximum takeoff weight up to 5700 kg, and motor gliders, as laid down in regulations in Germany, are detailed. International noise regulations on the official admission of aircraft are discussed.
ESRO

N74-26483# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
SYSTEMATIC SOUND INSULATION INVESTIGATIONS [SYSTEMATISCHE UNTERSUCHUNGEN AUF DEM GEBIET DER SCHALLABSCHIRMUNG]
H. Hoelscher 15 Feb. 1974 30 p refs In GERMAN Presented at the DGLR Symp. Triebwerkslaerm, Brunswick, 21 Feb. 1974 Sponsored by Bundesmin. fuer Forsch. und Technol.
(MBB-UH-06-74-O; DGLR-Paper-74-021) Avail: NTIS HC $4.50

Acoustic measurements on nonabsorbing and absorbing planes with one, two, and three diffracting edges and one round edge at different distances from the shielding plane were carried out. The results were evaluated and compared with similar experiments of other authors.
ESRO

N74-26484# Propellerwerk Hoffmann G.m.b.H. U. Co. Kg Hoco, Rosenheim (West Germany).
QUIET PROPELLERS FOR CIVIL AVIATION. PRESENT SITUATION, FUTURE DEVELOPMENT [LEISERE PROPEL-

LER FUER DIE ALLGEMEINE LUFTFAHRT-GEGENWAERTIGE SITUATION, ZUKUNFTSERWARTUNG]
Reinhard Hoffmann and Gerd Muehlbauer 1974 17 p refs In GERMAN Presented at the DGLR Symp. Triebwerkslaerm, Brunswick, 20-21 Feb. 1974
(DGLR-Paper-74-023) Avail: NTIS HC $4.00

Possibilities to reduce propeller aircraft noise, including diminishing the propeller diameter, profiling the propellers, and using new propeller construction material such as wood-composite material, are discussed. Future developments are outlined: engine performance and thrust, new types of engines, and lowering of propeller speed. ESRO

N74-26485# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
HELICOPTER ROTOR NOISE AND POSSIBILITIES FOR ITS REDUCTION [LAERMERSCHEINUNGEN BEI HUBSCHRAUBERROTOREN UND MOEGLICHKEITEN ZUR LERMMINDERUNG]
V. Langenbucher 8 Feb. 1974 17 p refs In GERMAN Presented at the DGLR Symp. Triebwerkslaerm, Brunswick, 20-21 Feb. 1974
(MBB-UD-118-74-O; DGLR-Paper-74-024) Avail: NTIS HC $4.00

Helicopter rotor and tail rotor noise production, including blade slap, rotation sound, and rotor noise, is discussed. Measures to reduce the noise are outlined. Noise reduction of tail rotors was investigated experimentally and future developments are indicated. ESRO

N74-26486# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
COMPARISON OF FOKKER F-28 WIND TUNNEL AND FLIGHT DATA, A SUMMARY
J. T. M. VanDoorn, L. J. Erkelens, S. O. T. H. Han, and Y. G. Kho 5 Jan. 1973 41 p refs Sponsored by Neth. Agency for Aerospace Res.
(NLR-TR-73007-U) Avail: NTIS HC $5.25

For an accurate prediction of aircraft characteristics, the wind tunnel tests are of paramount importance. Therefore the significance of the test results and available extrapolation techniques have to be investigated as thoroughly as possible. For this reason a program for comparing wind tunnel and flight test data of the Fokker F-28 was set up, comprising lift, development of flow separation at low speed, high speed buffet boundary, drag, pitching moments, ground effects, and elevator hinge moment derivatives. The investigation confirmed that full-scale characteristics of the aircraft can in general be predicted from model experiments within an acceptable accuracy with the aid of existing knowledge about scale effects and corrections applied to the wind tunnel test results. A futher refinement of prediction methods and test techniques is nevertheless desirable. Author (ESRO)

N74-26487# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYTICAL APPROACH TO OPTIMIZING AIRFRAME PRODUCTION COSTS AS A FUNCTION OF PRODUCTION RATE M.S. Thesis
Peter F. Fazio and Stephen H. Russell Jan. 1974 177 p refs
(AD-775698; SLSR-30-74A) Avail: NTIS CSCL 01/3

The objective of the research is to analyze all elements of airframe production cost in terms of their sensitivity to production rate and to identify a methodology which will optimize the rate of production with respect to total airframe costs for a fixed procurement quantity. GRA

N74-26488# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLIGHT CONTROL OF AIRPLANES AND HELICOPTERS
V. T. Borodin and G. I. Rylsky 21 Mar. 1974 357 p refs Transl. into ENGLISH of the book "Upravlenie Poletom Samoletov i Vertoletov" USSR, 1972 p 1-240
(AD-777297; FTD-MT-24-251-74) Avail: NTIS CSCL 01/3

The book provides an analysis and systematizes the basic results of foreign investigations into the automation of flight control of airplanes and helicopters. It presents the block diagrams and descriptions of the control systems of contemporary airplanes and helicopters, flexible aircraft, and also of adaptive (self-tuning, with variable structure, self-organizing) aviation systems. It examines the bionic principles of adaptation and the possibility of their use in control systems of aircraft, and also the problems of the automation of landings, flight at low and maximally low altitudes, and the integration of airborne equipment. It describes the methods for the display of flight information to the pilot, the system of semiautomatic control, the system for the prevention of the collision of airplanes in the air, landing systems, systems of profile flight, and contemporary complexes of airborne equipment. GRA

N74-26489# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
LIMIT CRITERIA FOR LOW COST AIRFRAME CONCEPTS Final Report, May - Nov. 1973
S. H. Yarbrough Oct. 1973 109 p refs
(Contract F33615-73-C-3126; AF Proj. 1368)
(AD-777572; Rept-2-57110/3R-3126; AFFDL-TR-73-140) Avail: NTIS CSCL 01/3

The report presents the results of a study program which evaluated the primary cost factors of selected airframe baseline components and alternate designs compatible with low cost concepts. The data from this study is compiled and presented in a ready reference format defined as the Limit Criteria. Six A-7D aircraft components representing the characteristic stress types were selected as the baseline designs, then a minimum of two or more alternate designs were selected for each component. The baseline and alternates were analyzed and estimated on the basis of strength, stiffness, fracture toughness, weight and cost. Weight and cost of the design variations was plotted on a Cost/Weight/Value Diagram of each component for direct comparison of current design results. (Modified author abstract) GRA

N74-26490# Sage Action, Inc., Ithaca, N.Y.
A CORRELATION STUDY OF IN-FLIGHT VIBRATION MEASUREMENTS FOR PATROL-TYPE AIRCRAFT Technical Report, 15 Oct. 1968 - 30 Jun. 1971
P. Tan Dec. 1973 51 p refs
(Contract N00014-69-C-0031; NR Proj. 215-039)
(AD-777668; SAI-RR-7303; TR-1) Avail: NTIS CSCL 01/3

A correlation study of vibration data for patrol-type and similarly-configured aircraft in turbulence-free, straight and level flight is presented. All of the known existing measurements for six planes are examined. A free-free uniform beam with a single lumped mass at midspan for the fuselage, together with an approximate representation of the exciting forces, is proposed as a mathematical model. The expression for the vibrational response is derived by the second form of the Ritz method. Computed results for the double displacement amplitude spectrums are compared with the measured data and found to agree very well. A simple correlation formula is also developed. Author (GRA)

N74-26491# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATION OF THE LANDING CONTROL OF AIRCRAFT
S. L. Belogorodskii 7 Mar. 1974 517 p refs Transl. into ENGLISH of the book "Avtomatizatsiya Upravleniya Posadkoi Samoleta", 1972 p 1-351
(AD-777174; FTD-MT-24-720-73) Avail: NTIS CSCL 01/2

Questions on the automation of one of the most complex stages of flight -- the landing of the aircraft -- are examined. The operating principles of the radio technical devices utilized for formation of landing trajectories are illuminated. Questions of the dynamics of semiautomatic and automatic aircraft control are presented and block diagrams and features of domestic and foreign systems of automated landing control of aircraft are examined. GRA

N74-26492# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
DEVELOPMENT OF CARGO SLINGS WITH NONDESTRUCTIVE CHECKOUT SYSTEMS Final Report
Horace T. Hone, Walter E. Huebner, and Donald J. Baxter Feb. 1974 166 p refs

(Contract DAAJ02-72-C-0008; DA Proj. 1F1-63209-DB-33) (AD-777497; SER-50859; USAAMRDL-TR-73-106) Avail: NTIS CSCL 01/3

The report describes the design, fabrication and testing of the following equipment which was developed to extend the facilities for carrying external loads on U.S. Army helicopters: four-legged wire rope slings of 6,000, 25,000 and 60,000 pounds nominal capacity, four-legged nylon rope slings of 6,000 and 25,000 pounds nominal capacity, nylon rope pendants of 6,000 and 20,000 pounds nominal capacity for use in conjunction with the 6,000- and 25,000-pound slings, and nondestructive test apparatus for the wire rope slings. Author (GRA)

N74-26493# Mechanical Technology, Inc., Latham, N.Y.
PREDICTION OF GEAR-MESH-INDUCED HIGH-FREQUENCY VIBRATION SPECTRA IN GEARED POWER TRAINS
Alston L. Gu and Robert H. Badgley Jan. 1974 91 p refs (Contract DAAJ02-72-C-0040; DA Proj. 1G1-62207-AA-72) (AD-777496; MTI-73TR28; USAAMRDL-TR-74-5) Avail: NTIS CSCL 01/3

Characteristics of vibration spectra induced by gear meshes in both single gear reductions and planetary gear reductions were investigated. Methods were developed to analyze the planet-pass induced vibrations which exist in normal planetary gear reduction systems. It was found that the planet-pass vibration sideband frequencies occur both below and above the base signal at integer multiples of planet-pass frequency and that the sideband amplitudes may exceed that of the base signal. The effect of planet pair phasing on the vibration sideband spectra was determined for the CH-47 helicopter forward rotor drive transmission first-stage planetary reduction. A computer-implemented analysis was established for predicting vibration sidebands produced by variations in centerline distance, tooth transmitted force, and tooth support discontinuities for single gear mesh systems. (Modified author abstract) GRA

N74-26494# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTONOW'S TRANSPORT PLANE
M. Jurleit 28 Mar. 1973 17 p refs Transl. into ENGLISH from Flieger Revue (East Germany), no. 8, 1973 p 358-362 (AD-777661; FTD-HC-23-1256-74) Avail: NTIS CSCL 01/3

The translation briefly reviews Soviet transport plane development and design. GRA

N74-26495# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
PROGRAM PLAN FOR INVESTIGATION OF MODEL E-11C-1 AIRPLANE CATAPULT AND HOLD-BACK OPERATIONS CAPACITY
Louis Berman 25 Mar. 1974 29 p refs
(AD-777435; NADC-74058-30) Avail: NTIS CSCL 01/2

A laboratory fatigue test will be performed on an E-1 airframe to determine whether the airframe will sustain the effects of 3,000 catapult launches without structural failure. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-26496# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CALCULATION AND COMPARISON OF THE ECONOMY OF ELECTROCHEMICAL FUEL CELLS
Franz A. Pohl, Harald Bohm et al May 1973 21 p refs Transl. into ENGLISH from Wiss. Ber. AEG-Telefunken (West Germany), v. 45, 1972 p 141-146
(NTC-74-11868; Rept-73-145) Avail: NTIS HC $4.25; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The characteristics and operating principles of electrochemical fuel cells are discussed. The economy of typical fuel cells is calculated and the economy of different low temperature fuel cells is compared. It was determined that the tungsten carbide/carbon fuel cell is more economical than the other low temperature fuel cells investigated. Mathematical models are developed to show the manner in which the comparisons were conducted. Author

N74-26497*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Dept. of Electrical Engineering.
DIGITAL COMPUTER SIMULATION OF INDUCTOR-ENERGY-STORAGE dc-TO-dc CONVERTERS WITH CLOSED-LOOP REGULATORS
Anil K. Ohri, Harry A. Owen, Thomas G. Wilson, and G. Ernest Rodriguez 18 Jun. 1974 41 p refs Presented at the 1974 Spacecraft Power Conditioning Electron. Seminar, Frascati, Italy, 20-22 May 1974
(Grant NGL-34-001-001)
(NASA-TM-X-69467) Avail: NTIS HC $5.25 CSCL 10A

The simulation of converter-controller combinations by means of a flexible digital computer program which produces output to a graphic display is discussed. The procedure is an alternative to mathematical analysis of converter systems. The types of computer programming involved in the simulation are described. Schematic diagrams, state equations, and output equations are displayed for four basic forms of inductor-energy-storage dc to dc converters. Mathematical models are developed to show the relationship of the parameters. Author

N74-26498*# General Electric Co., Schenectady, N.Y.
STUDY, SELECTION, AND PREPARATION OF SOLID CATIONIC CONDUCTORS Final Report, 13 Nov. 1972 - 12 Nov. 1973
W. L. Roth and O. Muller Apr. 1974 69 p refs
(Contract NAS3-17339)
(NASA-CR-134610; SRD-74-034) Avail: NTIS HC $6.50 CSCL 10C

Crystal chemical principles and transport theory have been used to predict structures and specific compounds which might find application as solid electrolytes in rechargeable high energy and high power density batteries operating at temperatures less than 200 C. Structures with 1-, 2-, and 3-dimensional channels were synthesized and screened by nuclear magnetic resonance, dielectric loss, and conductivity. There is significant conductivity at room temperature in some of the materials but none attain a level that is comparable to beta-alumina. Microwave and fast pulse methods were developed to measure conductivity in powders and in small crystals. Author

N74-26499*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF EAGEL-PICHER INDUSTRIES, INCORPORATED, 20.0 AMPHERE-HOUR NICKEL-CADMIUM SPACECRAFT CELLS
J. D. Harkness 25 Mar. 1974 28 p
(NASA Order S-23404-G)
(NASA-CR-138611; QEEL/C-74-228) Avail: NTIS HC $4.50 CSCL 10C

An evaluation test of the 20.0 ampere-hour cells was conducted to insure that all cells put into the life cycle program are of high quality. This is accomplished by the screening of cells found to have electrolyte leakage, internal shorts, low capacity, or inability of any cell to recover its open circuit voltage above 1.150 volts during the internal short test. The results obtained in the test are given, as well as the recommendations based on these findings. D.L.G.

N74-26500*# Georgia Inst. of Tech., Atlanta. Schools of Mechanical and Nuclear Engineering.
COMPARATIVE EVALUATION OF SOLAR, FISSION, FUSION, AND FOSSIL ENERGY RESOURCES. PART 5: CONCLUSIONS AND RECOMMENDATIONS Final Report
J. R. Williams 11 Apr. 1974 9 p refs
(Grant NGR-11-002-166)
(NASA-CR-138631) Avail: NTIS HC $4.00 CSCL 10A

An analysis was conducted to determine the effects of using fuels other than fossil fuels to alleviate the energy crisis. The uses of solar energy and nuclear energy are examined and their

impact on the environment is assessed. The increasing content of carbon dioxide due to the burning of fossil fuels is analyzed. Recommendations are made for eliminating the use of fossil fuels and maximizing the use of solar energy, nuclear energy, and geothermal energy. Author

N74-26501*# Eagle-Picher Co., Joplin, Mo. Couples Dept.
STUDY OF PROCESS VARIABLES ASSOCIATED WITH MANUFACTURING HERMETICALLY-SEALED NICKEL-CADMIUM CELLS Final Report
Lee Miller Apr. 1974 226 p refs
(Contract NAS5-21159)
(NASA-CR-139025) Avail: NTIS HC $14.50 CSCL 10C

A two year study of the major process variables associated with the manufacturing process for sealed, nickel-cadmium, areospace cells is summarized. Effort was directed toward identifying the major process variables associated with a manufacturing process, experimentally assessing each variable's effect, and imposing the necessary changes (optimization) and controls for the critical process variables to improve results and uniformity. A critical process variable associated with the sintered nickel plaque manufacturing process was identified as the manual forming operation. Critical process variables identified with the positive electrode impregnation/polarization process were impregnation solution temperature, free acid content, vacuum impregnation, and sintered plaque strength. Positive and negative electrodes were identified as a major source of carbonate contamination in sealed cells. Author

N74-26502*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: CYCLE LIFE TEST Annual Report
D. E. Christy and J. D. Harkness 15 Feb. 1974 261 p
(NASA Order S-23404-G)
(NASA-CR-138604; QEEL/C-74-34; AR-10) Avail: NTIS HC $16.25 CSCL 10A

Cycle life tests of secondary spacecraft cells are reported. The purpose of the cycle program is to determine the cycling performance capabilities of packs of cells under different load and temperature conditions. A summary of the results of life cycling programs is given. Weaknesses discovered in cell design are analyzed. Cells are tested on the basis of depth of discharge, temperature effects, and orbit period. The test facilities used in the program are described. Author

N74-26503# Arizona Univ., Tucson. Optical Sciences Center.
RESEARCH APPLIED TO SOLAR-THERMAL POWER SYSTEMS Semiannual Progress Report, 1 Jan. - 30 Jun. 1973
B. O. Seraphin 10 Apr. 1973 57 p refs
(Grant NSF GI-36731X)
Avail: NTIS HC $6.00

Research on a new approach to a selective solar energy converter that can be used to transform solar radiation into high temperature heat was conducted. This heat can be transferred and applied in a steam turbine-generator unit to produce electricity. The selective solar energy converter is basically a two-layered construction in which the top layer is a semiconductor material, such as silicon, having high absorption for solar radiation and high transparency for black body radiation from the heated unit. The bottom layer is a metal film having high reflectance. Author

N74-26504*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL HEATING AND COOLING SYSTEM
10 May 1974 80 p
(NASA-TM-X-70089; M-TU-74-3) Avail: NTIS HC $7.00 CSCL 10A

Efforts to demonstrate the engineering feasibility of utilizing solar power for residential heating and cooling are described. These efforts were concentrated on the analysis, design, and test of a full-scale demonstration system which is currently under construction at the National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Alabama. The basic solar heating and cooling system under development utilizes a flat plate solar energy collector, a large water tank for thermal energy storage, heat exchangers for space heating and water heating, and an absorption cycle air conditioner for space cooling. Author

N74-26505# Committee on Interior and Insular Affairs (U. S. Senate).
GEOTHERMAL RESOURCES, PART 1 The Potential for the Production of Power from Geothermal Resources
Washington GPO 1973 294 p refs Hearing before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 13 Jun. 1973
(GPO-21-438) Avail: Subcomm. on Water and Power Resources

The potential for the production of electricity and heat energy from geothermal sources is projected and requirements for Federal programs in exploration, research, and development of geothermal resources are considered. G.G.

N74-26506# Committee on Interior and Insular Affairs (U. S. Senate).
GEOTHERMAL RESOURCES, PART 2 The Potential for the Production of Power from Geothermal Resources
Washington GPO 1974 484 p refs Hearing before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 10 Aug. 1973 (Idaho Falls, Idaho) and 11 Aug. 1973 (Klamath Falls, Oreg.)
(GPO-26-473) Avail: Subcomm. on Water and Power Resources

The progress of technology in the development of geothermal resources is considered for solving the particular energy problems of the Pacific Northwest. G.G.

N74-26507*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTED ENERGY DENSITITES FOR NICKEL-HYDROGEN AND SILVER-HYDROGEN CELLS EMBODYING METALLIC HYDRIDES FOR HYDROGEN STORAGE
Robert W. Easter 1974 11 p refs Proposed for Presentation at 9th Intersoc. Energy Conversion Eng. Conf., San Francisco, 26-30 Aug. 1974
(NASA-TM-X-71556; E-7981) Avail: NTIS HC $3.00 CSCL 10A

Simplified design concepts were used to estimate gravimetric and volumetric energy densities for metal hydrogen battery cells for assessing the characteristics of cells containing metal hydrides as compared to gaseous storage cells, and for comparing nickel cathode and silver cathode systems. The silver cathode was found to yield superior energy densities in all cases considered. The inclusion of hydride forming materials yields cells with very high volumetric energy densities that also retain gravimetric energy densities nearly as high as those of gaseous storage cells. Author

N74-26508*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF FEP ENCAPSULATED SOLAR CELL MODULES USED IN TERRESTRIAL APPLICATIONS
A. F. Ratajczak and A. F. Forestieri 1974 7 p refs Proposed for presentation at 9th Intersoc. Energy Conversion Eng. Conf., San Francisco, 26-30 Aug. 1974
(NASA-TM-X-71564; E-7998) Avail: NTIS HC $3.00 CSCL 10A

The Lewis Research Center has been engaged in transferring the FEP encapsulated solar cell technology developed for the space program to terrestrial applications. FEP encapsulated solar cell modules and arrays were designed and built expressly for terrestrial applications. Solar cell power systems were installed at three different land sites, while individual modules are undergoing marine environment tests. Four additional power systems are being completed for installation during the summer of 1974. These tests have revealed some minor problems which have been corrected. The results confirm the inherent utility of FEP encapsulated terrestrial solar cell systems. Author

N74-26509# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
SOLAR THERMAL ELECTRIC POWER SYSTEMS Progress

Report, 1 May - 30 Jun. 1973
Jul. 1973 78 p refs Prepared in cooperation with Westinghouse Elec. Corp., Boulder, Colo.
(Grant NSF GI-37815)
Avail: NTIS HC $7.00 CSCL 10A

A research project in the generation of electric power from solar energy was conducted. The objective of the research was an appraisal of methods for converting solar energy to electricity and a determination of promising methods for future development. The subjects discussed are: (1) the characteristics of solar collectors, (2) heat storage, (3) systems optimization methods, (4) cost estimation, and (5) ranking alternatives for solar energy supply to utilities. The materials used in solar collectors are identified and typical solar collector configurations are examined. Author

N74-26510# Committee on Science and Astronautics (U. S. House).
ENERGY FROM GEOTHERMAL RESOURCES
Washington GPO May 1974 96 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 10 May 1974 Prepared by Library of Congr.
(GPO-32-309) Avail: Subcomm. on Energy

The technology for utilizing dry steam deposits for electric power is reasonably well advanced, but these deposits are uncommon in nature. Exploitation of these deposits will provide valuable additions to local power supplies. The unit power cost of dry steam is well under that of fossil and nuclear fuels and dry steam has less adverse environmental impact. Using the steam will likewise conserve conventional fuels, which may then be used elsewhere or for other purposes. Wet steam and hot water electric power plants are more expensive than the dry steam plants, but such deposits are much more common. The technology is, again, reasonably, but not totally, developed; corrosion remains a major problem. As with the case of dry steam deposits, in areas containing wet steam and hot water resources, conventional fuels can be saved and the environment protected by the construction of geothermal power plants and by using the remaining hot water for such secondary purposes as space heating, the extraction of minerals, and as a source of potable water. Author

N74-26511*# Stanford Research Inst., Menlo Park, Calif.
FABRICATION AND TEST OF INORGANIC/ORGANIC SEPARATORS Final Report, Nov. 1972 - Jan. 1974
J. S. Smatko Feb. 1974 73 p refs
(Contract NAS3-17344)
(NASA-CR-134646; SRI-PYU-2285) Avail: NTIS HC $6.75 CSCL 10C

Completion of testing and failure analysis of MDC 40 Ahr silver zinc cells containing largely inorganic separators was accomplished. The results showed that the wet stand and cycle life objectives of the silver zinc cell development program were accomplished. Building, testing and failure analysis of two plate cells employing three optimum separators selected on the basis of extensive screening tests, was performed. The best separator material as a result of these tests was doped calcium zirconate. Author

N74-26512*# Linguistic Systems, Inc., Cambridge, Mass.
OPERATING CONDITIONS AND TYPES OF WIND-POWER ELECTRIC SUBSTATIONS FOR RURAL AREAS
V. R. Sektorov Washington NASA May 1974 17 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 10, Oct. 1949 4 p
(Contract NASw-2482)
(NASA-TT-F-15517) Avail: NTIS HC $4.00 CSCL 10A

The efficiency of regimes of work of wind motor electric generating sets, working in a system jointly with other power stations, with constant and variable speed of rotation of the windmill, is compared. A method is given for evaluating the possible percentage of participation of wind driven installations in the power supply of rural regions, based on the future power balances of the regions and the technical conditions for the operation of wind driven installations. Author

N74-26513*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPERATURE, ILLUMINATION AND FLUENCE DEPENDENCE OF CURRENT AND VOLTAGE IN ELECTRON IRRADIATED SOLAR CELLS
A. F. Obenschain and T. J. Faith (RCA, Princeton, N. J.) Dec. 1973 32 p refs Prepared in cooperation with RCA, Princeton, N. J.
(Contract NAS5-21642)
(NASA-TM-X-70671; X-761-74-23) Avail: NTIS HC $4.75 CSCL 10A

Emperical equations have been derived from measurements of solar cell photovoltaic characteristics relating light generated current, IL, and open circuit voltage, VO, to cell temperature, T, intensity of illumination, W, and 1 Mev electron fluence, phi both 2 ohm-cm and 10 ohm-cm cells were tested. The temperature dependency of IL is similar for both resistivities at 140 mw/sq cm; at high temperature the coefficient varies with fluence as phi 0.18, while at low temperatures the coefficient is relatively independent of fluence. Fluence dependent degration causes a decrease in IL at a rate proportional to phi 0.153 for both resistivities. At all intensities other than 560 mw/sq cm, a linear dependence of IL on illumination was found. The temperature coefficient of voltage was, to a good approximation, independent of both temperature and illumination for both resistivities. Illumination dependence of VOC was logarithmic, while the decrease with fluence of VOC varied as phi 0.25 for both resistivities. Author

N74-26514# California Univ., Livermore. Lawrence Livermore Lab.
ANALYSIS OF THE WINDS OF SITE 300 AS A SOURCE OF POWER
P. B. Archibald 23 Oct. 1973 17 p refs
(Contract W-7405-eng-48)
(UCRL-51469) Avail: NTIS HC $4.00

Site 300 is a strategically located area lying east of the Lawrence Livermore Laboratory at Livermore, California. The prevalent wind is from the west, its driving force is the pressure gradient between the hot interior valley and the cool marine air of the Pacific Ocean. Wind measurements indicate that this is a good site for electrical power generation. Author (NSA)

N74-26515# Sandia Labs., Albuquerque, N.Mex.
TRANSCRIPT OF TALK ON SOLAR ENERGY
R. P. Stromberg Dec. 1973 16 p Presented to Environ. Comm. of the Western Systems Coordinating Council at a Meeting hosted by the Public Service Co. of New Mexico, Albuquerque, 24-25 Sep. 1973
(Contract AT(29-1)-789)
(SLA-73-1025) Avail: NTIS HC $3.00

A transcript of a solar energy talk is reported that emphasizes the potential for a solar community. Author (NSA)

N74-26516# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
BATTERY SYSTEM WITHIN THE ENERGY SUPPLY FOR AEROS [BATTERIESYSTEM INNERHALB DER ENERGIEVERSORGUNG AEROS]
Gerd Winzer 1973 27 p refs In GERMAN Presented at the DGLR Symp. Wiss. Tech. Ergeb. des Aeros Programms, Meersburg, West Ger., 18-19 Oct. 1973 Sponsored by Bundesmin. fuer Bildung und Wiss.
(DGLR-Paper-73-149) Avail: NTIS HC $4.50

A battery system for the electric power supply of Aeros was developed. A silver-zinc battery with a minimum supply of 260 Wh was chosen for the start and acquisition phase. For the orbit phase a nickel-cadmium battery with a coulometer cell as a charge control element was selected. The technical specifications of the batteries are given and the mission results are discussed. ESRO

N74-26517# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugzeugsteuerung und -regelung.
RELIABILITY OF HYDRAULIC COMPONENTS. REDUNDANT ELECTROHYDRAULIC SERVOACTUATORS
Johannes Tersteegen Jan. 1973 73 p refs In GERMAN; ENGLISH summary
(DLR-MITT-73-28) Avail: NTIS HC $6.75; DFVLR, Porz, West

Ger. 16,50 DM

The demand for reliability in electrohydraulic servoactuators used in connection with fly-by-wire leads to redundancy. In describing the various basic concepts of redundancy, the effects of a failure on the system performance are discussed. Theoretical studies show the effect of load sharing caused by the use of closed-center sliding spoolvalves in case two or more channels are operating simultaneously with different input signals. Various techniques can be used to cut down the problem of load sharing. Principal ways of constructing reliable servoactuators, as well as hardware example, are described. Author (ESRO)

N74-26518# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.

PRELIMINARY REPORTS, MEMORANDA AND TECHNICAL NOTES OF THE MATERIALS RESEARCH COUNCIL SUMMER CONFERENCE. VOLUME 2: PROCEEDINGS OF THE DISCUSSION GROUP ON SOLAR ENERGY CONVERSION

Edward E. Hucke Jul. 1973 296 p refs Conf. held at La Jolla, Calif., Jul. 1973

(Contract DAHC15-71-C-0253; ARPA Order 2341)

(AD-777737) Avail: NTIS CSCL 10/2

Discusses applications of solar energy, concentration and collection of solar energy, photovoltaic conversion, ocean thermal gradients, energy storage, and fuel cells. GRA

N74-26519# Carnegie-Mellon Univ., Pittsburgh, Pa.

SOLAR SEA POWER Semiannual Progress Report, 1 Nov. 1973 - 31 Jan. 1974

Clarence Zener, Abrahim Lavi, Robert Rothfus, Francis McMichael, and Chin Chang Wu 25 Jan. 1974 113 p refs

(Grant NSF GI-39114)

(PB-228068/3; NSF-RANN/SE/GI-3911/PR-74-2; NSF-RA/N-74-003) Avail: NTIS HC $4.50 CSCL 10B

A conceptual design is developed which in no way depends upon ocean currents, and in which all physical processes are well understood. Contamination of the input water to the boiler by the output water is avoided by taking advantage of the naturally occurring density stratification, at least for plants which do not exceed 700,000 kilowatts. High density power generation without moisture, and the consequent power expenditure in its removal, is obtained by falling film evaporation on vertical tubes. Appreciable pressure drop in the large banks of vertical tubes in the evaporator and condenser is avoided by proper manifolding. The optimization scheme is shown to be capable of handling 30 variables and 20 constraints within a compilation and running computer time less than a minute. GRA

N74-26520# Carnegie-Mellon Univ., Pittsburgh, Pa.

SOLAR SEA POWER Quarterly Progress Report, 1 Jun. - 30 Sep. 1973

Clarence Zener, Abrahim Lavi, and Ching Chang Wu 11 Oct. 1973 140 p refs

(Grant NSF GI-39114)

(PB-228069/1; NSF-RA/N-73-063; NSF-Rann/SE/GI-39114/PR-73-1; QPR-1) Avail: NTIS HC $4.75 CSCL 10B

The first quarterly report analyzes the physical principles involved in the most critical components of a Solar Sea Power Plant. These critical components are considered to be the boiler, condenser, turbine, cold water pipe (approximately 2,000 ft long, approximately 60 ft diameter). The following conclusions have been obtained. Boiler: Because of the slow rise of bubbles in fluids, and because of the low power available for separating moisture from vapor, film evaporation is preferred to pool boiling. Condenser: The heat transfer in condensers may be greatly improved by an optimally designed, contoured surface. Turbine: The available temperature drop of 10C for the heat engine is sufficient to drive a single stage turbine with 50% reaction in stator and in rotor, and with maximum gas velocities of 740 ft/sec. Cold Water Pipe: Elastic instability, the mode of failure most difficult to guard against, may be controlled by two concentric 1/8 in. pipes spaced 2 in. apart, with an appropriate filler. GRA

N74-26521# Carnegie-Mellon Univ., Pittsburgh, Pa.

PROCEEDINGS, SOLAR SEA POWER POWER PLANT CONFERENCE AND WORKSHOP Final Report

Abrahim Lavi Jun. 1973 288 p refs Conf. held Pittsburgh, 27-28 Jun. 1973

(Grant NSF GI-39115)

(PB-228066/7; NSF-RA/N-73-064) Avail: NTIS HC $6.75 CSCL 10B

On June 27 and 28, 1973 a national conference was convened for discussions on ocean thermal energy conversion. Its objectives were to afford an opportunity for information exchange, identification of key problems, and for discussions of how to implement the sea solar power plant technology. Summaries of the working groups' outputs are presented for the following topics: power plant siting; economic and political problems; environmental considerations; low temperature gradient heat transfer; turbines and fluids; plant anchoring; and cold water pipe design. GRA

N74-26522# Delaware Univ., Newark. Inst. of Energy Conversion.

EFFECT OF SHADING ON CdS/Cu(x)S SOLAR CELLS AND OPTIMAL SOLAR ARRAY DESIGN

Mohamed Sayed and Larry Partain 13 Jun. 1973 55 p refs

(Grant NSF GI-34872)

(PB-227900/8; NSF-RANN/SE/GI-34872-73-4) Avail: NTIS HC $3.75 CSCL 10B

The effects of shading on solar arrays in general has been analyzed using the specific I-V characteristics of a CdS/Cu(x)S solar cell. The major differences in the amount of power lost with various array configurations subjected to identical shading conditions has been determined. The conditions under which localized heating or 'hot spots' occur has been treated and the criteria for their avoidance has been precisely defined. The effects of protective diodes in reducing power loss and in preventing hot spots has been included. General design rules to assist in obtaining optimal solar structures have been formulated and presented. Author (GRA)

N74-26523# Massachusetts Univ., Amherst.

RESEARCH APPLIED TO OCEAN SITED POWER PLANTS Annual Progress Report, 1 Jan. - 31 Dec. 1973

J. Hilbert Anderson 25 Jan. 1974 69 p refs

(Grant NSF GI-34979)

(PB-228067/5; NSF-RA/N-74-002) Avail: NTIS HC $3.75 CSCL 10B

One total system configuration for a 400 mWe ocean thermal power plant has been conceptualized. Enough work has been accomplished to show that concept could be replicated in a broad swatch in the Gulf Stream along the U.S. southeast coast. Subsystems have been reduced to diagrams and major components have been sized. A complete math model of the total heat engine cycle has been created and parametric studies are now possible with reasonable computer time expenditures. One 1100 mWe submerged nuclear power plant has been arranged and balanced. GRA

N74-26524# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POSSIBILITIES FOR INCREASING THE TECHNICAL LEVEL AND SPECIFIC WEIGHT AND VOLUMETRIC ELECTRICAL RATING CHARACTERISTICS OF CHEMICAL SOURCES OF CURRENT

P. V. Ogromnov and L. P. Savelchikov 21 Mar. 1974 16 p Transl. into ENGLISH from Vses. Nauchn.-Issled. Akkumuliatornyi Inst., Sb. Rabot po Khim. Istochnikam Toka (USSR), no. 4, 1969 p 3-10

(AD-777665; FTD-MT-24-400-74) Avail: NTIS CSCL 10/3

The authors consider the contemporary state of the production of chemical current sources at battery plants and the ways of improving the future design and technology of storage batteries. GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-26525* + National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 127, APRIL 1974
Apr. 1974 85 p refs
(NASA-SP-7011(127)) Avail: NTIS HC $4.00 CSCL 06E

This special bibliography lists 279 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1974. Author

N74-26526*# Southwest Research Inst., San Antonio, Tex.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Final Report, 25 Aug. 1972 - 15 Nov. 1973
David F. Culclasure, John L. Sigmon, and Jean M. Carter 5 Nov. 1973 297 p refs
(Contract NASw-1867; SwRI Proj. 13-2538)
(NASA-CR-138502) Avail: NTIS HC $17.00 CSCL 06C

The activities are reported of the NASA Biomedical Applications Team at Southwest Research Institute between 25 August, 1972 and 15 November, 1973. The program background and methodology are discussed along with the technology applications, and biomedical community impacts. F.O.S.

N74-26527# Joint Publications Research Service, Arlington, Va.
CURRENT PROBLEMS IN SPACE BIOLOGY AND MEDICINE
14 Jul. 1972 162 p Transl. into ENGLISH of the publ. "Aktualnyye Voprosy Kosmicheskov Biologii i Meditsiny" Moscow, 1971
(JPRS-56499) Avail: NTIS HC $11.25

A collection of articles devoted to current research conducted in space biology and medicine using cosmonaut, animal, and plant life on the Soyuz spaceship are presented. Special attention was given to the function of body organs and physiological responses during space flight stress. For individual titles, see N74-26528 through N74-26588.

N74-26528 Joint Publications Research Service, Arlington, Va.
PULMONARY VOLUMES AND UNIFORMITY OF VENTILATION OF TWO COSMONAUTS MAKING AN 18 DAY SPACE FLIGHT
V. A. Andretsov and V. A. Kiryanov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 1-2 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 6-7 (For availability see N74-26527 16-04)

Pulmonary volumes and the uniformity of ventilation were studied by the open system method based on the expulsion of nitrogen from the lungs when breathing pure oxygen. The investigations were made in the mornings, while fasting, prior to onset of the 18-day flight, and on the fourth and eleventh days after its termination. In order to exclude the influence of terrestrial gravitation on blood redistribution in the body, the investigations were made in a water medium at the time of body immersion up to the neck level. All the data were reduced to BTPS. Author

N74-26529 Joint Publications Research Service, Arlington, Va.
QUANTITATIVE EVALUATION OF PHYSIOLOGIC INDICES OF COSMONAUTS DURING FLIGHT OF THE SOYUZ-6 - SOYUZ-8 SPACESHIPS
L. V. Antonenko, A. A. Butusov, V. A. Dzerzhanovskaya, A. D. Yegorov, N. A. Ivashkina, G. G. Ignatova, V. R. Lyamin, A. P. Polyakova, and I. B. Svistunov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 3-5 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 7-9 (For availability see N74-26527 16-04)

In conducting medical monitoring an evaluation of the health of cosmonauts during spaceflight is made on the basis of information received during radio conversations and television contacts, by an analysis of the registered physiologic parameters and the microclimatic parameters in the manned compartments, and by conducting medical self- and mutual-monitoring. In the process of decoding the physiologic parameters, the frequency of cardiac contractions and the respiration rate were ascertained, and the principal indices of the electrocardiogram and seismocardiogram were measured. The principal objectives of the quantitative evaluation and the statistical analysis of physiologic data are defined. Author

N74-26530 Joint Publications Research Service, Arlington, Va.
SOME RESULTS OF USING DISPERSION ANALYSIS FOR EVALUATING THE PHYSIOLOGIC REACTIONS OF COSMONAUTS DURING FLIGHT OF THE SOYUZ-3, SOYUZ-4, AND SOYUZ-5 SPACESHIPS
V. I. Antonova, A. A. Butusov, V. A. Dzerzhanovskaya, A. D. Yegovor, N. A. Ivashkina, G. G. Ignatova, V. R. Lyamin, A. P. Polyakova, and I. B. Svistunov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 6-8 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 9-11 (For availability see N74-26527 16-04)

During the space flight of the Soyuz-3, Soyuz-4, and Soyuz-5 ships, radiotelemetric systems were used in registering such physiologic parameters as the electrocardiogram (ECG), seismocardiogram (SCG), and pneumogram (PG). In processing this information it was possible to determine the frequency of cardiac contractions and the respiration rate, and the principal ECG and SCG indices for each cosmonaut were measured. The collected data were grouped in accordance with the stages in training and conducting space flight. Author

N74-26531 Joint Publications Research Service, Arlington, Va.
STUDY OF CHOLESTEROL METABOLISM IN DOGS EXPOSED TO THREE YEAR CHRONIC GAMMA IRRADIATION
D. B. Antipenko and A. A. Akhunov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 9-11 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 12-14 (For availability see N74-26527 16-04)

An investigation was undertaken to determine the effect of chronic irradiation over a three-year period on the cholesterol content in the serum of dogs. Observations were made on 30 male dogs who were irradiated daily for 22 hours using a Co-60 gamma irradiation source. The results indicate that chronic irradiation made it possible to detect definite impairments in the cholesterol content in the blood serum of dogs. Author

N74-26532 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN CONSTRUCTING A SYSTEM FOR THE AUTOMATIC PROCESSING OF PHYSIOLOGIC INFORMATION c05
O. N. Apanasyuk, I. S. Shadrintsev, and A. A. Ignatov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 12-14 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 16-19 (For availability see N74-26527 16-04)

Some results are presented of the practical application of the basic principles involved in constructing a system for the automated processing of physiological information (APPI) based on an M220-A computer. In addition to this computer, the APPI system includes a device for coupling the information sources to the computer at the input and for coupling the computer at the output with devices for the printout and representation of the processed information. Also included devices for the preliminary processing of physiologic signals (PPD) ensuring the compression of information prior to computer input or input into a magnetic recorder. Author

N74-26533 Joint Publications Research Service, Arlington, Va.
EFFECT OF ACCELERATIONS, PROLONGED HYPOKINESIA AND THEIR TOTAL EFFECT OF TOLERANCE TO A PHYSICAL LOAD TEST
O. I. Boykova and T. V. Benevolenskaya *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 15-16 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 24-25 (For availability see N74-26527 16-04)

The objective was an investigation of a number of factors

simulating spaceflight factors on tolerance to a physical load on the basis of EKG data. Tests were conducted on a bicycle-type ergometer a day before and a day after exposure to accelerations, 120-day clinostatic hypokinesia, and the combined effect of peak accelerations and 62-day hypokinesia. The intensity of the load was 500 kg.m/min and the working time was eight minutes. The EKG was registered when conducting the test. Forty clinically healthy males in the age group 23 to 45 years were studied, and the results are presented. Author

N74-26534 Joint Publications Research Service, Arlington, Va.
COLICINOGENIC CHARACTERISTICS OF ESCHERICHIA ISOLATED FROM HUMAN SUBJECTS DURING CONFINEMENT IN AN ISOLATION CHAMBER
M. P. Bragina *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 25-26 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 17-18 (For availability see N74-26527 16-04)

A total of 540 cultures of coliform bacteria isolated from three subjects confined for a period of one month in an isolation chamber were investigated for ascertaining colicinogenic activity. The investigations revealed that colicinogenic enteric bacteria were detected prior to beginning of the experiment in all three subjects. During the experiment changes were observed in the dynamics of appearance of Escherichia with colicinogenic activity. This was expressed in an increase (subject Ch-v) or decrease (G-v and M-o) in the number of colicinogenic cultures. Individual differences were also in the quantitative content of colicinogenic strains in the subjects after the experiment. Author

N74-26535 Joint Publications Research Service, Arlington, Va.
EFFECT OF 120-DAY HYPOKINESIA ON HUMAN CHROMOSOMES
N. N. Bobkova and L. P. Grinio *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 19-20 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 28-29 (For availability see N74-26527 16-04)

The chromosomes of four clinically healthy males in the 23 to 30 age group were studied in a culture of leukocytes of the peripheral blood. Chromosomal aberrations were determined in accordance with generally accepted practices. An analysis of the chromosomes in subjects prior to hypokinesia revealed that chromatid and chromosomal aberrations were observed, but the types of impairments and their number did not exceed the limits of physiological normalcy. After hypokinesia, the relative number of chromosomal impairments did not exceed the limits of variation of spontaneous aberrations. It was concluded that no cytogenetic effect in human subjects accurred during the 120-day hypokinesia experiment. Author

N74-26536 Joint Publications Research Service, Arlington, Va.
CHANGES IN THE MORPHOLOGICAL COMPOSITION OF THE BLOOD AND BONE MARROW DURING HYPOKINESIA AND PRESSURE CHAMBER TRAINING
I. I. Britvan and M. A. Dotsenko *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 21-22 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 32-33 (For availability see N74-26527 16-04)

A study was made on common male rats to determine the effect of preliminary adaptation to hypoxic hypoxia on tolerance of the hypokinetic effect. Data on the morphological composition of the peripheral blood and bone marrow were used in the experiment. Stepped acclimatization to hypoxic hypoxia was accomplished by ascent of the animals in a pressure chamber for 10 days each to altitudes of 3,000 5,000, and 7,000 m. Thirty-day hypokinesia was created by placing them in special hypokinetic cages. The rats were divided into three groups. The first group underwent preliminary acclimatization to hypoxic hypoxia and were then subjected to hypokinesia; the second group were exposed to 30-day hypokinesia without preliminary acclimatization; the third group were control animals. It was found that preliminary adaptation to hypoxic hypoxia probably smooths out changes in the morphological composition of the blood and bone marrow caused by the influence of 30-day hypokinesia. However, the overall picture of changes in the cell composition, characterizing the hypokinetic effect, remains. Author

N74-26537 Joint Publications Research Service, Arlington, Va.
PHYSIOLOGIC REACTIONS OF COSMONAUTS REGISTERED DURING FLIGHT OF THE SOYUZ-9 SPACESHIP
A. A. Butusov, A. D. Yegorov, V. R. Lyamin, A. P. Polyakova, and I. B. Svistunov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 23-25 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 36-38 (For availability see N74-26527 16-04)

An assessment in made of the medical data obtained during the 18-day flight of Soyuz-9. The reactions of the circulatory system to a special functional test with a carefully measured standard physical load were registered, and an important place was given to medical self- and mutual monitoring carried out by the cosmonauts during the flight. Comparisons are drawn of the effect of various space flight factors on cardiac contractions, the dynamics of respiration rates, and arterial pressure. An analysis of the physiological reactions indicated that the cosmonauts remained in good health and achieved an adequate performance level. Author

N74-26538 Joint Publications Research Service, Arlington, Va.
CHANGE IN SOME SEISMOCARDIOGRAPHIC INDICES DURING 120-DAY HYPOKINESIA
V. A. Boldov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 26-27 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 49-50 (For availability see N74-26527 16-04)

The seismocardiography (SCG) method was used to obtain data on 10 healthy males durning a 120-day hypokinesia experiment. The subjects, from 22 to 46 years of age, were divided into three groups. The first was the control group; the second group was given pituitrin and DOSCA; and the third received nerabol. The SCG was studied every 10 days at the same time of day. The results show that 120-day hypokinesia causes a change in myocardial contractability which has a phase character. However, it was found that nerabol decreases these changes. Author

N74-26539 Joint Publications Research Service, Arlington, Va.
EVALUATING THE EFFECT OF ATMOSPHERIC PURIFICATION AND REGENERATION SYSTEMS ON THE DEGREE OF CONTAMINATION OF THE ATMOSPHERE BY MICROBES IN TIGHTLY SEALED SPACES
A. N. Viktorov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 28-29 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 57-58 (For availability see N74-26527 16-04)

Summary data presented on the results of comparative of air purification and regeneration systems. It was found that a system employing silica gel and synthetic zeolites maintained the microbial contamination of the atmosphere at a lower level than a system based on the use of peroxide compounds. Author

N74-26540# Joint Publications Research Service, Arlington, Va.
ROLE OF THE ATMOSPHERE AS A FACTOR ON TRANSFER OF INFECTION DURING PROLONGED ISOLATION OF HUMAN SUBJECTS IN SEALED ROOMS
A. N. Viktorov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 30 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 61 (For availability see N74-26527 16-04)

Experimental results are summarized to show that during the prolonged isolation of human subjects in a tightly sealed room there is a considerable increase in the role played by the atmosphere in transfer of infectious agents. Author

N74-26541 Joint Publications Research Service, Arlington, Va.
STUDY OF RENAL FUNCTIONING IN HEALTHY SUBJECTS USING THE RADIOISOTOPIC RENOGRAPHY METHOD

DURING A 120-DAY PERIOD OF EXPERIMENTAL HYPOKINESIA

A. I. Grigoryev *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 31-32 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 85-86 (For availability see N74-26527 16-04)

Radioisotopic renography was carried out when the subjects were lying on their stomachs, twice during the background and restoration periods, and five times during the period of hypokinesia. The investigation was made using a gamma radiometric apparatus. The level radioactive radiation in the blood and in the kidneys was registered using a six-channel potentiometer. Three curves were registered: blood clearance, and separate renograms of the right and left kidneys. Many indices of water-mineral metabolism and kidney function were also determined. A definite interrelationship was found between changes in water-electrolyte metabolism, glomerular filtration rate, renal plasma flow, and data from a renographic investigation. During some experimental periods, circulation in the kidneys was the decisive factor in change in the rate of isotope absorption and evacuation; in others it was the secretory capacity of cells in the renal tubes. Author

N74-26542 Joint Publications Research Service, Arlington, Va.
STUDY OF THE GAS EMANATION OF A NUMBER OF POLYMERS DURING THEIR PROLONGED STORAGE c18

A. I. Gorshunova and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 33-39 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 89-93 (For availability see N74-26527 16-04)

Chemical and chromatographic analyses methods were used to study the gas release of several polymers in the course of their prolonged storage. An attempt was also made to detect the postulated products of aging of synthetic materials (aldehydes, CO, HCl, and others) in the gas phase. In most cases, the results indicate an exponential dependence of the concentration of volatile substances in the gas phase on the time the polymers were stored. With a definite degree of probability, this makes it possible to predict their gas release. Author

N74-26543 Joint Publications Research Service, Arlington, Va.
DYNAMICS OF HUMAN CARDIAC SINUS RHYTHM IN EXPERIMENTS WITH INVERSION OF THE WORK AND REST SCHEDULE

Ye. I. Gavrikov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 40-41 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 97-98 (For availability see N74-26527 16-04)

The collected data indicate that a study of cardiac sinus rhythm can be used as a criterion for evaluating the rate and nature of human adaptation to inversion of the work and rest schedule. It is evident that individuals retaining more slowly with a predominance of vagotonic reactions during this period. Individuals with predominantly sympathicotonic reactions, that is, more labile individuals, restructure more rapidly and, subjectively, the restructuring for them transpires more easily. The research data make it possible to recommend individuals with the first type of reaction to prolonged sleeplessness for work requiring the assimilation of different new work and rest schedules. Author

N74-26544 Joint Publications Research Service, Arlington, Va.
UTILIZATION OF THE WASTES IN A BIOENGINEERING COMPLEX IN A LIFE SUPPORT SYSTEM c05

T. S. Guryeva, N. A. Markova, and L. M. Krasotchenko *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 42-43 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 102-103 (For availability see N74-26527 16-04)

As the waste of higher plants contain a considerable quantity of mineral elements, a method was developed for extracting them without oxygen expenditures. The proposed method makes it possible to ensure return of up to 30% of the mineral elements to the closed cycle of the life support system. Author

N74-26545 Joint Publications Research Service, Arlington, Va.
PHYSIOLOGIC AND HYGIENIC EVALUATION OF EXPERIMENTAL SAMPLES OF COSMETICS c18

V. V. Zhidkov, L. S. Belikova, V. P. Gorshkov, G. A. Shumilina, and G. N. Komzalova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 44-46 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 111-113 (For availability see N74-26527 16-04)

The composition of certain lotions, elixirs, and shaving creams was tested in two isolation chamber experiments lasting 22 and 30 days in which the atmosphere and microclimate were carefully controlled. The experimental samples of these personal hygiene items were evaluated on the basis of dermatophysiological indices, physical examinations, the subjective opinions of the users, and their possible effect on the functioning of some life support systems. Author

N74-26546 Joint Publications Research Service, Arlington, Va.
EFFECT OF NARCOTICS ON ANIMAL BODY REACTIVITY DURING HYPOKINESIA

L. Ya. Kolemeyeva and M. A. Seydametov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 47-48 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 126-127 (For availability see N74-26527 16-04)

The influence of drugs on body reactivity in animals during hypoxia of different durations was investigated. Classical narcotics which have a predominant effect on different parts of the nervous system - hexanal, chloral hydrate, and urethane - were used. The experiments were made on white male rats. Results show: (1) an increased reactivity occured in experimental rats exposed to chloral hydrate at all times during the experiment and a decrease in reactivity to urethane. (2) Under the influence of hexanal there was an increase in reactivity on the first, thirtieth, and sixtieth days of hypokinesia and a decrease in reactivity during the remaining times. (3) In experimental animals sleep occurred later after administration of the narcotics and was less prolonged than the control rats. Author

N74-26547 Joint Publications Research Service, Arlington, Va.
RESPONSE OF THE ANIMAL BODY TO CENTRAL NERVOUS SYSTEM STIMULANTS DURING HYPOKINESIA

L. Ya. Kolemeyeva *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 49-50 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 127-128 (For availability see N74-26527 16-04)

A study was made of central nervous system stimulants with a predominant effect on different parts of the central system. The stimulants used were strychnine, phenamine, and caffeine. Change in body response of while rats to injections of the stimulants was evaluated from the time on onset of the following reactions: in the case of strychnine injection from onset of adynamia. Data show that during hypokinesia there is a decrease in body response of the animals to strychnine and phenamine and an increase in body response to caffeine. Author

N74-26548 Joint Publications Research Service, Arlington, Va.
DIET DURING A YEARLONG MEDICAL ENGINEERING EXPERIMENT c05

A. N. Kozlova and G. N. Savelyeva *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 51-52 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 147-149 (For availability see N74-26527 16-04)

A physiologic-biochemical evaluation was made of an experimental diet designed for a yearlong medical engineering experiment. The following basic requirements were considered. (1) a constancy of good taste qualities and the external appearance of the foods, (2) adequancy of the foods for the anticipated physiologic requirements with retention of performance and human health, (3) a high assimilability of food products, (4) minimum weight and volume of the ration, and (5) prolonged (not less than a year) preservability of the foods. Results indicate that

there is a definite possibility of formulating a prolonged human diet based on foods rehydrated from a dehydrated state. Author

N74-26549 Joint Publications Research Service, Arlington, Va.
EFFECT OF 120-DAY HYPOKINESIA AND SOME PHARMACOLOGICALLY ACTIVE SUBSTANCES ON THE METABOLIC INDICES OF VITAMINS E, C AND B6 c05
Ye. V. Kolchin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 53-55 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 152-154 (For availability see N74-26527 16-04)

A study was made of the influence of 120 day hypokinesia and a combination of hypokinesia and administration of water-mineral and protein controlling pituitrin, DOCSA, and nerobal on the metabolic indices of vitamins E, C, and B 6. The experiment was conducted on healthy males distributed in three groups: group one for studying the effect of hypokinesia, group two for studying the joint effect of hypokinesia and pituitrin (and later DOCSA) on water-mineral metabolism, and group three for studying the joint effect of hypokenesia and nerobal on protein metabolism. The results show that 120 day hypokinesia does not exert an appreciable influence on the metabolism of vitamins C and B 6 in the first group. Injections of DOCSA in the second group led to a decrease in the excretion of vitamin C in the urine, whereas the administration of nerobal in the third group led to a decrease in the excretion of 4-pyridoxynic acid. Author

N74-26550 Joint Publications Research Service, Arlington, Va.
CONSTRUCTING MEDICAL MONITORING EQUIPMENT FOR TRANSMITTING DATA THROUGH A COMMUNICATION CHANNEL WITH LIMITED CAPACITY c05
V. I. Kozharinov and N. V. Rozov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 56-60 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 156-160 (For availability see N74-26527 16-04)

Procedures and equipment for compressing and transmitting physiological information through limited space communication channels were evaluated. Two principle classes of compression methods were considered: (1) those techniques which ensure retention of signal shape at the receiving end of the radio link within the limit of a stipulated error and (2) techniques which provide for measuring definite characteristics of the signal, including the statistical characteristics. E.H.W.

N74-26551 Joint Publications Research Service, Arlington, Va.
SYSTEMATIC APPROACH IN MEDICAL SUPPORT OF LONG SPACE FLIGHTS
L. M. Komarova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 61-63 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 160-163 (For availability see N74-26527 16-04)

Some aspects of the application of the systematic approach to the creation of a medical research information system for the onboard hospital are investigated. E.H.W.

N74-26552 Joint Publications Research Service, Arlington, Va.
STUDY OF VOLATILE SUBSTANCES RELEASED BY POLYMERS BASED ON POLYETHYLENE HALOGEN DERIVATIVES c18
Ye. V. Kolchina, V. D. Yablochkin, V. A. Shchirskaya, A. I. Gorshunova, and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 64-68 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 166-169 (For availability see N74-26527 16-04)

Gas chromatography, spectrophotometry, and sanitary-chemical procedures were used to study the gas release of samples of a number of polymer construction materials made from polyethylene halogen derivatives. Six materials, three each from polyvinyl chloride and polytetrafluoroethylene were analyzed. Two materials, medical plastic and plasticized polyvinyl chloride tubing were investigated only at temperatures of 20 C; other samples were studied at temperatures from 40 C with a 10 day exposure period, and at increased temperatures of 80, 100, 150, and 200 C with 2 to 3 hours exposure. Investigative results are given in tabular form. E.H.W.

N74-26553 Joint Publications Research Service, Arlington, Va.
EFFECT OF SKILL IN UNDERWATER ORIENTATION ON PERCEPTION OF THE GRAVITATIONAL VERTICAL c05
S. N. Makarov and B. B. Bokhov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 69 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 175-176 (For availability see N74-26527 16-04)

A vertical instrument was used to study the differential sensitivty (up and down position) of the vestibular, skin, and motor analyzers of human underwater. Attempts were made to establish a correlation between training and sensitivity. Six groups were used to test the theory. Group one consisted of athletes engaged in underwater orientation, group two was composed of second class adult and third class youth categories, groups three and four were composed of underwater swimmers with less experience (100 to 500 hrs.), divers made up group five, and group six was made up of subjects with no experience in underwater dives. All tests were made on land. The results indicated a high accuracy in orientation in the first group in comparison with the control group. The magnitude of the error in the third and fourth groups was approximately the same, but on the average was less than in the control group. In the fifth group, consisting of divers, the indices did not differ from the control data. Thus, immersion in water increases orientation accuracy under definite conditions. Author

N74-26554 Joint Publications Research Service, Arlington, Va.
EFFECT OF TEN-DAY PRESENCE IN A HYPEROXIC ATMOSPHERE ON THE CIRCULATORY REACTION UNDER A MAXIMUM PHYSICAL LOAD
V. M. Mikhaylov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 70-72 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 180-182 (For availability see N74-26527 16-04)

An experiment was conducted on the admissible time for human exposure in an atmosphere with an increased oxygen content. For this purpose an experiment was conducted in which two subjects for a period of ten days were exposed in a pressure chamber with a hyperoxic mixture containing 53.8%. Twice a day, for 30 minutes the subjects performed a complex of physical exercises. A day before and a day after ending the experiment a test was conducted with a maximum physical load using an electric bicycle-type ergometer. Subject one exhibited an increase duration of the cardiac cycle and the tension period at the expense of the isometric contraction phase. The time of asynchronous contraction and blood expulsion period did not change, arterial pressure varied little from the control levels. Subject two exhibited a decrease in the duration of cardiac cycle and expulsion period. There was a corresponding increase in the asynchronous contraction phase and the expulsion period by 0.01 sec. Some increase in pulse amplitude occurred and the final systolic blood pressure increased. Author

N74-26555 Joint Publications Research Service, Arlington, Va.
PHYSICAL PERFORMANCE AND FUNCTIONAL STATE OF THE CARDIORESPIRATORY SYSTEM IN MAN AFTER TEN-DAY CONFINEMENT IN A HYPEROXIC MEDIUM
G. V. Machinskiy *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 73-74 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 182-184 (For availability see N74-26527 16-04)

An investigation was made of the effect of prolonged confinement in an atmosphere with a high O2 content on human physical performance. The functional state of the cardiorespiratory system as well as the level of physical performance of the subjects was investigated prior to onset of the experiment and a day after its termination using a test with an increasing physical load, performed on a bicycle-type ergometer. A comparison of the results of the background and post experimental examinations revealed that ten-day confinement in a hyperoxic medium exerted no appreciable influence on the quantitative indices of maximum physical performance. However, the pulse rate with which the

subjects ended work after the experiment became greater than that prior to the experiment in one subject by 8% and in another by 14%. The maximum O2 consumption decreased in both subjects. Author

N74-26556 Joint Publications Research Service, Arlington, Va.
STUDY OF THE HUMAN CARDIOVASCULAR SYSTEM REACTION WHEN PERFORMING FUNCTIONAL TESTS DURING A YEARLONG EXPERIMENT
G. A. Manovtsev and A. A. Savilov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 75-76 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 187-188 (For availability see N74-26527 16-04)

An investigation was made of the orthostatic stability and physical performance of subjects during a yearlong experiment in a ground experimental complex of life support systems. Tests were made of pulse rate, arterial pressure, and ECG, and the change in the chronocardiogram, the cardiac stroke, and minute volumes. The results obtained show that during the first months of confinement there was an increase in the physical conditioning of the subjects. During the second half of the experiment there was a tendency toward a decrease in physical performance. Examinations after the experiment also revealed some decrease in orthostatic stability of the subjects: during the course of the tests there were unpleasant subjective sensations, expressed autonomic reactions, and indications of blood stagnation in the lower extremities, as well as a change in the studied hemodynamic indicies. Author

N74-26557 Joint Publications Research Service, Arlington, Va.
STUDY OF PSYCHIC PERFORMANCE DURING MODIFICATION OF THE DAILY SCHEDULE
A. L. Narinskaya *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 77-78 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 199-200 (For availability see N74-26527 16-04)

The results of a study on individual characteristics of the dynamics of psychic performance during man's adaptation to an unusual work and rest schedule are presented. Two pairs of subjects were selected from two groups segregated during an experiment with 72-hour sleeplessness. Both pairs of subjects were exposed successively to two 45-day experiments in an isolation chamber. During the first stage of the 45-day experiments the dynamics of performance was studied for a normal daily regime. On the 11th day there was an inversion of the daily schedule: a shift by 12 hours. After the shift psychic performance was studied using the same psychological methods. The results of the study indicate an individual character of the process of adaptation to a new regime. The decrease in the indices of psychic performance for the more rhythmic subjects was greater than for less rhythmic subjects. Author

N74-26558 Joint Publications Research Service, Arlington, Va.
DYNAMICS OF PSYCHIC PERFORMANCE DURING CONTINUOUS 72-HOUR WAKEFULNESS
A. L. Narinskaya *In its* Current Probl. in Space Biol. and Med. (JPRS-564499) 14 Jul. 1972 p 79-80 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 201-202 (For availability see N74-26527 16-04)

An investigation was made of psychic performance during a 72 hour period of continuous wakefulness. Experiments were made using male subjects in the age group from 25 to 36 years. Tests cover (1) reproduction of a tex (cognitional voluntary memory), (2) complicated conversion of figures into letters, (3) addition of numbers with switching, (4) making corrections, and (5) number and letter combinations (capacity for working when a time deficit prevails). The collected data indicate that performance levels for all methods during the 72 hour period decreased in all subjects. Data also show a deterioration in the productivity of mental performance, concentration and stability of attention, a slowness in mental processes, and difficulties in working when there was a deficit. Author

N74-26559 Joint Publications Research Service, Arlington, Va. c05
SOME PECULIARITIES OF COMMUNICATION PROCESSES IN SMALL GROUPS
T. V. Novikova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 81-82 Transl. into ENGLISH from the Publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 207-208 (For availability see N74-26527 16-04)

A study was made of the influence of phenamine on oral communication processes in 12 pairs of healthy subjects performing interdependent activity which consisted of a number of homeostatic problems of increasing complexity. During the course of their activity the subjects were afforded the opportunity of using a conversation device. All problems were classified according to their complexity: (1) simple problems not requiring separation of the function, (2) complex problems for successful solution requiring separation of the tactics of the subjects by type of leader, and (3) conflicting (irresolvable) problems. An analysis of the number of oral reactions of the subjects revealed that in solving problems of the first type a minimum number of oral communications is used. In the process of solving problems of the second type this number increased in the background experiment by a factor of five, with the administration of phenamine by a factor of six, and in solving conflicting problems, in the background experiment by a factor of 24 and with the administration of phenamine by a factor of 18. Author

N74-26560 Joint Publications Research Service, Arlington, Va.
STATE OF THE HUMAN GASTRIC SECRETORY FUNCTION WITH INTAKE OF AN ARTIFICIAL RATION
L. S. Potemkina *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 83 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 213 (For availability see N74-26527 16-04)

A study was made of the reaction of gastric glands in human subjects to a diet of an artificial nature for 45 days. Data show that there was a tendency toward a decrease in the acid forming function in the subjects and a depression of exosecretion and incretion of pepsinogen. This reaction of the secretory processes in the stomach was probably associated with the peculiarities of the experimental ration: the use of casein as a protein source. It is known that casin is a protein with an uncoiled configuration of molecules and this affords a good possibility for its digestion by the proteolytic enzymes in the digestive system. The denaturation of casein is not accompanied by an increase in the rate of proteolysis, as is characteristic for ordinary globular proteins, but by its decrease. Author

N74-26561 Joint Publications Research Service, Arlington, Va.
COMPARATIVE CHARACTERISTICS OF MORPHOLOGICAL CHANGES IN THE KIDNEYS OF RATS DURING MULTI-HOUR EXPOSURE TO TRANSVERSE AND LONGITUDINAL ACCELERATIONS WITH AN INTENSITY OF FOUR G
A. S. Pankova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 84-88 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 215-219 (For availability see N74-26527 16-04)

A study was made of morphological changes in the kidneys of rats exposed to accelerations depending on the duration and direction of the exposure, and the detection of compensatory-adaptive reactions caused by the influence of hypothalamic-hypophyseal neurosecretory system. Consideration was also given to the decrease in hemodynamic disorders. Author

N74-26562 Joint Publications Research Service, Arlington, Va.
STUDY OF THE SUCCESSIVE EFFECT EXERTED ON THE BODY BY CENTRIPETAL ACCELERATIONS WITH A VARIABLE VECTOR AND CORIOLIS ACCELERATIONS
B. I. Polyakov and V. G. Andreyeva *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 89-91 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 220-222 (For availability see N74-26527 16-04)

A comparative evaluation was made of the level of vestibular stability of human subjects before and after their rotation on a centrifuge. The subjects (seven clinically healthy males in nonflight occupations in the age group 23-46 years) were subjected to transverse accelerations of 4 g with a duration up

to 10 minutes or 6 g with a duration up to five minutes and simultaneously rotation about their own longitudinal axis with velocities of 15 and 60 deg/sec. The level of vestibular stability was determined by tolerance to a test with cumulation of Coriolis accelerations which was conducted twice: a day prior to rotation on the centrifuge and 40 to 150 minutes afterwards. The criterion for tolerance to the test was the time from its onset to the appearance of autonomic reactions of the first and second degree. Results are given in tables. Author

N74-26563 Joint Publications Research Service, Arlington, Va.
SOME PARAMETERS OF HEMODYNAMICS AND ENERGY EXPENDITURES OF CREW MEMBERS OF THE SOYUZ-6, 7 SPACESHIPS
Yu. D. Pometov and V. V. Shchigolev *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 92-93 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 227 (For availability see N74-26527 16-04)

A study of hemodynamics and gas exchange of crew members of the Soyuz-6 and 7 ships was made under basal metabolism conditions a month before the launching and also on the second and fourth days after the flight was completed. The minute volume of circulation (MVC) was determined by the method of return breathing of CO2 and gas exchange (oxygen consumption and release of carbon dioxide --(VO2, VCO2) was ascertained by the modified Douglas-Holden method. On the second day after landing all the cosmonauts exhibited an increase in the MVC averaging 4.01 + or - 0.13 to 4.75 + or - 0.28 liters/minute or by 14.7%. In a repeated determination on the fourth day the MVC increased on the average for the group by 5% in comparison with the preceding investigation. Author

N74-26564 Joint Publications Research Service, Arlington, Va.
USE OF AN M-220 ELECTRONIC COMPUTER FOR AUTOMATIC PROCESSING OF EXTERNAL RESPIRATION PARAMETERS **c08**
L. A. Rustamyan, N. I. Vikhrov, V. D. Skosyreva, and L. R. Iseyev *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 94-95 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 230-232 (For availability see N74-26527 16-04)

A description is given of a computer system for the automatic processing of external respiration parameters. The system is designed to measure inhalation and exhalation volume, duration of inhalation, exhalation and respiratory cycle, respiration rate, O2 consumption, VO2 (gas exchange parameter) and CO2 release, and VCO2. Author

N74-26565 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF APPLYING THE AUTOGENIC TRAINING METHOD FOR COSMONAUTS **c05**
A. P. Ragulin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 96 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 234 (For availability see N74-26527 16-04)

The inclusion of the autogenic training method in the training of cosmonauts was proposed. Physiologically, the method is based on the relationship between the functional state of the central nervous system and the tone of the striated muscles. After a three month training period, medical observation and test data show a decrease in fatigue and also a shortening of the recovery period after exercises in the experimental group as compared to the control group. E.H.W.

N74-26566 Joint Publications Research Service, Arlington, Va.
CHANGES IN OXYGEN CONSUMPTION BY THE HUMAN BODY UNDER THE INFLUENCE OF RESTRICTED DIET, HYPOKINESIA AND CENTRIFUGE ACCELERATIONS
G. I. Smirnova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 97-98 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 242-243 (For availability see N74-26527 16-04)

An investigation was made of oxygen consumption in healthy males between the ages of 23 and 36 while under the influence of restricted diet, hypokinesia, and centrifugal accelerations. Six of the subjects in the first series were confined to a hospital without a special restriction of motor activity. During the second and third series the investigated persons during the 15 days of the EP adhered to a bedrest regime with a rigorous restriction of motor activity. In addition, in the third series prior to the onset and after ending of the bedrest regime the subjects were exposed to transverse accelerations on a centrifuge. Results show the VO2 (gas exchange) gradually decreased in the first experiment and the subjects lost weight on the average of 3 kg. In the second experiment there was a decrease in VO2 by the end of the bedrest confinement. Subjects in this group lost an average of 4 kg. in the third test series a marked decreased occurred in VO2 after centrifuge tests. In the middle of the experimental period VO2 increased sharply but decreased by the end of the bedrest period. Mean weight losts for the subjects was 2 kg. Author

N74-26567 Joint Publications Research Service, Arlington, Va.
SOME INDICES OF PROTEIN AND LIPID METABOLISM IN HUMAN BEINGS WHEN CONSUMING A RATION DEVELOPED FOR SPACESHIP CREWS DURING FLIGHT WITH A DURATION UP TO A MONTH
T. A. Smirnova and O. S. Khokhlova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 99-101 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 245-247 (For availability see N74-26527 16-04)

Healthy males from 19 to 34 years of age were used to study the effects of space rations on protein and lipid metabolism. The rations consisted of canned meats, dehydrated meat and dairy products, meat pies and chocolate in tubes, confectionary items, and other foods. There were 2708 calories in the diet broken down as follows: 144 g protein, 106 g fats, and 276 g carbohydrates. Mean averages for the above processes are given in tables. Data show that such a diet did not cause reliable changes in protein and lipid metabolism and that the indicies are within the limits of accepted physiologic variables. Author

N74-26568 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDY OF A METHOD FOR THE PARTIAL OXIDATION OF THE PRODUCTS OF MAN'S VITAL FUNCTIONS
G. S. Sinyak, T. S. Guryeva, M. V. Kuzmenko, V. V. Popov, and G. I. Chizhizhikova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 102-103 Transl. into ENGLISH from the oubl. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 254-255 (For availability see N74-26527 16-04)

Attempts were made to establish the partial oxidation method as a viable technological procedure for processing the products of man's vital functions. Experiments were carried out on waste products taken from subjects placed on a definite diet. The use of catalysts caused a considerable decrease in oxidation temperature during the vapor phase, a more complete oxidation of the components in the gas phase, and an improvement in the quality of the condensate. Test results show that the method makes it possible to determine more accurately technological paramenters and principle computation formulas for processing human waste. E.H.W.

N74-26569 Joint Publications Research Service, Arlington, Va.
RELIABILITY OF ARTERIAL PRESSURE MEASUREMENTS MADE BY PERSONS NOT HAVING A MEDICAL EDUCATION **c05**
V. F. Turchaninova and T. G. Chernysh *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 104-105 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 259-260 (For availability see N74-26527 16-04)

Investigations were made of ways of developing a method for teaching the measurement of arterial pressure (AP) to individuals not having a medical education and for evaluating the reliability of the data which they collect. Seven males in the age group from 25 to 35 years were taught to measure AP by the Korotkov method. Teaching involved familiarization of the trainees with the earlier formulated instructions on measuring AP and conducting three exercises with themo. An evaluation of the accuracy of AP measurement by the trainees was made

during the 20 to 30 days following training. The results indicate that individuals not earlier having appropriate skills but who acquire them in a short time (three exercises) measure AP with an adequate accuracy. Author

N74-26570 Joint Publications Research Service, Arlington, Va.
EFFECT OF A MODIFIED ATMOSPHERE ON BLOOD ACID-ALKALI EQUILIBRIUM
S. I. Tokarev *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 106-107 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 260-262 (For availability see N74-26527 16-04)

A study was made of blood acid-alkali equilibrium during prolonged experiments. During man's five day confinement in a medium with a high CO2 content (PCO2 22.8 to 45.6 mm Hg) there was a decrease in the pH and an increase in P(a)CO2 and the level of true bicarbonates. A shift in the active reaction of the blood in an acidic direction of a respiratory nature was completely compensated during presence in an atmosphere with PCO2 = 22.8 mm Hg. With PCO2 = 30.4 mm Hg, on the first day there was evidence of decompensation, but on the days which followed acidosis was also completely compensated. A further increase in PCO2 in the surrounding medium led to the development of decompensated shifts in pH of a respiratory and metabolic nature. Accordingly, during prolonged (up to five days) presence in a hypercapnic medium the human body can adapt quite fully to an increased CO2 concentration (up to 22.8 mm Hg. Author

N74-26571 Joint Publications Research Service, Arlington, Va.
MODELING THE RELIABILITY PARAMETERS OF ORGANS USING ONE TYPE OF FINITE AUTOMATIC DEVICES **c05**
A. M. Tarko *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 108-109 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 262-263 (For availability see N74-26527 16-04)

Proposals were made for the design of finite automatic devices for evaluating the reliable operation of body organs during prolonged space flight stress. The proposals were based on the premis that organs consist of great number of elements of the same type operating on an all or nothing principle. They have the characteristics of excess and fatigability, making it possible for the elements to operate for very long periods. Author

N74-26572 Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF THE METHOD FOR REGISTERING THE INDICES OF PHYSIOLOGIC FUNCTIONS ON THE SOYUZ-9 SPACESHIP **c05**
V. A. Talavrinov, A. G. Zerenin, I. V. Sokolov, and V. F. Turchinova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 110-111 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 265-267 (For availability see N74-26527 16-04)

A procedure for collecting physiological data from cosmonauts wearing ECG electrodes without causing skin irritations was investigated. Important characteristics of the procedure are that: (1) the cosmonauts themselves put on and took off the systems of physiologic sensors, and (2) every day, in cases of continuous wearing, the ECG electrodes were moved to other parts of the skin on such a way that on each of the skin sectors designated for the purpose, the electrode was present for one day and the skin was free from it for three days. The cosmonaut himself processes the skin with a degreasing fluid, applies conducting paste to the electrodes, and also regulates the degree of tension of the elastic straps holding the electrode sensors in position. Test data show that using such a procedure did not cause skin irritations on prolonged space flights. Author

N74-26573 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL DATA ON DECOMPRESSION DISORDERS ACCOMPANYING ATMOSPHERIC RAREFRACTION
R. T. Tyurina and N. Yu. Leontyeva *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 112-114 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 267-269 (For availability see N74-26527 16-04)

An investigation was made of decompression disorders arising due to atmospheric rarefaction. Tests were carried out on cats for determining minimum altitude at which visible emboli appear in the blood, and dogs for studying external symptoms of high altitude decompression disorders. Test results show that in cats visible bubbles appear in individual animals at different altitudes. Minimum altitude at which bubbles were detected was 6,500 m. For external symptoms, no typical symptoms of the bends type were observed in dogs at altitudes of 10,000, 11,000, and 12,000 m. However when the animals were held from 5 to 8 hours in a RMK recompression chamber at excess pressures of 0.5, 0.8, 1.0, 1.2, 1.5, and 1.8 atm, and ascended to 10,000 m, a deterioration in general condition occurred. These syptoms, associated with an air embolism, were expressed to a greater or lesser degree depending on the pressure the animal was exposed to in the recompression chamber. The test data also revealed that symptoms of the bends type in a rarefied atmosphere do not develop as easily as with emergence from deep water. E.H.W.

N74-26574 Joint Publications Research Service, Arlington, Va.
UNDERWATER TRAINING AS ONE OF THE FACTORS INCREASING VESTIBULAR-AUTONOMIC STABILITY **c05**
A. A. Chirkov, L. N. Kornilova, and S. N. Markov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 115-117 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 286-287 (For availability see N74-26527 16-04)

The effect of underwater training on the somatic and autonomic components of the vestibular reactions was studied using healthy males in the age group from 29 to 37. The training, conducted under a specially formulated program, included different exercises performed under water: acrobatics (rotation in different planes and different types of figure swimming), diving and swimming in outfit No. 2 (with an aqualung) using a compass oriented by markers on the bottom and on the sun, underwater hunting, and motion picture surveys underwater. There was a total of 14 underwater training sessions, of which seven were directed to improving underwater orientation. Test data revealed that as a result of underwater training most of the persons in the main group exhibited an increase in vestibular-autonomic stability, a decrease in some vestibular-somatic reflexes, and an increase in the accuracy of orientation in two dimensional space. Author

N74-26575 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF VOLATILE SUBSTANCES RELEASED BY POLYMER CONSTRUCTION MATERIALS **c18**
V. D. Yablochkin, A. M. Popov, A. I. Gorshunova, V. A. Shchirskaya, Ye. V. Kolchina, and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 118-124 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 294-299 (For availability see N74-26527 16-04)

An examination was made of the combination of a complex of volatile substances released by some block, sheet, and granulated plastics under conditions simulating the external medium in which the polymer is used as construction materials. All the samples were studied at normal temperature and with exposure of 10 days. In addition most of the materials, other than pressed powder and ABS copolymer materials were investigated at increased temperature: 60, 100, 125, 150, 170, and 200 C for two hours. Data analysis show that at normal temperatures the composition of the products of gas release is dependent on the chemical structure of the polymers and the auxiliary substances used in the process of polymer synthesis. With an increase in temperature and a decrease in exposure from 10 days to two hours a number of nonspecific polymer oxidation products appear in the gaseous phase. It was concluded that temperature exerts a decisive effect on the gas release of polymer construction materials during their use. Author

N74-26576 Joint Publications Research Service, Arlington, Va.
STUDY OF WAYS TO REDUCE TOXIC GAS EMANATION OF POLYMERS **c18**
V. D. Yablochkin *In its* Current Probl. in Space Biol. and Med.

(JPRS-56499) 14 Jul. 1972 p 125 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 300 (For availability see N74-26527 16-04)

A study was made of the dependence of epoxy compound gas emanations on the composition of the epoxy base, hardener, and the presence of a filler. It was possible to establish the optimum ratio of the base and hardener at which, due to complete polymerization, there is no release of a monomer from the epoxy resin and ammonia from the hardener. It was found that the materials hardened by low molecular polyethylene polyamine or mixed amine-polyether hardeners release ammonia whereas in the products of gas release of samples hardened by high-molecular amine hardeners there is no release of the substance. Materials containing a filler release four or five times less toluene in comparison with samples without a filler. There is no evidence of a specific effects of the physiochemical properties of fillers on the gas emanation process. Author

N74-26577 Joint Publications Research Service, Arlington, Va.
STUDY OF VOLATILE SUBSTANCES RELEASED BY POLYMER CONSTRUCTION MATERIALS c18
V. D. Yablochkin, V. A. Shchirskaya, A. M. Popov, A. I. Gorshunova, Ye. V. Kolchina, and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 126-131 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 301-305 (For availability see N74-26527 16-04)

Qualitative and quantitative analyses were made of volatile substances released by polystyrene foam and porous polyurethane foam under conditions simulating the medium in which the materials are to be used. Results show polyurethane materials at normal temperature are more favorable in sanitary-chemical respects and concentrations of volatile substances released by them are relatively small, but at high temperatures polyurethanes can be a source of release of such highly toxic products as prussic acid and toluylene diisocyanate. Polystyrene foam releases a styrene monomer, acetone, ethanol, toluene, and m,p-xylenes. Ethyl benzene was released only during the thermal destruction of polystyrene at a temperature of 20 C. E.H.W.

N74-26578 Joint Publications Research Service, Arlington, Va.
STUDY OF WAYS TO REDUCE THE TOXIC GAS RELEASE OF POLYMERS c18
V. D. Yablochkin and V. A. Shchirskaya *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 132-134 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologi i Meditsiny" Moscow, 1971 p 305-308 (For availability see N74-26527 16-04)

The influence of thermostating and forming of sheets by hot rolling with synthetic resins on the release of volatile substances by a compound based on butylmethacrylic ester was investigated. Samples of the compound, subjected to thermostating, were investigated spectrophotometrically in the ultraviolet region for their content of low molecular substances extracted using ethanol. Data show that the greatest decrease in gas release was observed from samples of the compound rolled into sheets with synthetic resins. Thermostating at a temperature of 40 C for a period of 15 to 25 days exerts a considerably lesser effect on the gas release process in comparison with hot rolling, but with a temperature increase of 90 to 130 C there is a thermal destruction of the sample and as a result the concentration of the released low molecular substances increases. Author

N74-26579 Joint Publications Research Service, Arlington, Va.
THEORETICAL EVALUATION OF THE PERCENTAGE OF PARTICLES OF A MONODISPERSE AEROSOL REACHING THE ALVEOLAR ZONE OF THE LUNG
N. A. Isanin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 135 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 308 (For availability see N74-26527 16-04)

A theoretical analysis was made of the percentage of monodispersed aerosols reaching the aveolar of the lungs and the dependence between particle size and flowthrough. Computations were based on only one precipitation mechanism: gravity. It was also assumed that the spatial orientation of the bronchi is random. E.H.W.

N74-26580 Joint Publications Research Service, Arlington, Va.
SOME DATA ON THE FUNCTIONAL STATE OF THE HUMAN CARDIOVASCULAR SYSTEM DURING PROLONGED PRESENCE IN A TIGHTLY SEALED SPACE UNDER THE INFLUENCE OF HIGH CARBON DIOXIDE CONCENTRATIONS
I. I. Moykovskiy *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 136-138 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 309-311 (For availability see N74-26527 16-04)

The functional state of the human cardiovascular system during prolonged (200 hours) presence in a tightly enclosed room with a modified atmosphere was examined. The O2 content was 17 to 18% and the CO2 content was 4%. The pulse and respiration rates were registered constantly for each of the six subjects. In a study of the collected data a clear diurnal rhythm of the pulse rate and respiration rate was noted. During exposure to the modified atmosphere the diurnal rhythm of these parameters remains true and even becomes more clearly expressed. Beginning with the second or third day of the experiment some impairment in the diurnal rhythm was exhibited. In subject M-n beginning on the fifth to sixth day of the experiment, there was a clearly expressed tachycardia. It was concluded that a healthy person can remain in an atmosphere with 4% CO2 and 17 to 18% content O2 for a period of 200 hours. This is not the limit of duration. The changes in activity of individual parts of the cardiovascular system, sometimes marked, have the nature of adaptations and do not assume pathologic levels. Author

N74-26581 Joint Publications Research Service, Arlington, Va.
CHANGE IN HUMAN HEAT EXCHANGE INDICES UNDER THE INFLUENCE OF MICROCLIMATIC STRESSORS
S. S. Losev and I. I. Moykovskiy *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 139-140 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 311-312 (For availability see N74-26527 16-04)

Heat exchange indices were studied in nine healthy male volunteers over a seven-month period. The volunteers were subjected to 30 days isolation, during which twice each five days extremal conditions were created: first factor -- increase in ambient temperature to 34 C and increase in absolute humidity to 33 mm; second factor -- temperature increase to 33 C and absolute humidity to 22 mm and carbon dioxide to 2%. The following were registered by remote control: body temperature, skin temperature at five points, temperature of the exhaled air and mucosa, heat flux, perspiration, heat and pain thresholds of heat sensations. Data analysis show that the subjects experienced the greatest stressing of heat regulating mechanism during the period of exposure to the first factor. All the studied heat exchange indicies increased with a reliability greater than 98 to 99.9%, other than the heat flux, which decreased sharply and the temperature difference between the pain and heat thresholds, which also decreased. Exposure to the second factor produced no such stress of the heat regulating apparatus. Author

N74-26582 Joint Publications Research Service, Arlington, Va.
DETERMINING ETHYL ALCOHOL IN WATER CONDENSATES BY THE GAS CHROMATOGRAPHY METHOD c06
Yu. A. Novikov and A. V. Vikhlyantsev *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 141-142 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 319-320 (For availability see N74-26527 16-04)

A Tesvet gas chromatograph was used to determine the quantity of ethyl alcohol in water condensate compositions. Measurement data and results are given in tables. E.H.W.

N74-26583 Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPOXIA AT NORMAL BAROMETRIC PRESSURE ON THERMOTOGRAPHY OF THE SKIN AND HUMAN BODY TEMPERATURE
I. R. Abramov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 143-144 Transl. into ENGLISH

from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 320-321 (For availability see N74-26527 16-04)

The influence of hypoxia at normal barometric pressure on human body temperature was studied. Studies were made on clinically healthy persons who breathed a gas mixture impoverished in oxygen (O2 8-10%) at an external temperature of 18 to 20 deg and a relative humidity of 45 to 50%. The results of a thermometric study revealed that under these conditions the subject first exhibits a temperature shift in some parts of the skin. For example, the skin temperature of the forehead increased by 0.5 to 0.70 deg, whereas on the back and chest it was 1.3 to 1.50 deg. The temperature remained virtually unchanged on the extremities and for some subjects even decreased. With respect to body temperature (rectal temperature), it decreased in the range of 0.4 to 0.7 C. Author

N74-26584 Joint Publications Research Service, Arlington, Va.
HUMAN SKIN THERMOTOPOGRAPHY AND BODY TEMPERATURE DURING PROLONGED EXPOSURE IN A HYPERCAPNIC ATMOSPHERE AT NORMAL AND REDUCED BAROMETRIC PRESSURES
I. R. Abramov, I. I. Antonov, and R. T. Tyurina *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 145-146 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 321-323 (For availability see N74-26527 16-04)

Rectal and skin temperatures were studied in an environment containing from 3 to 6% CO2, in normal and reduced barometric pressures, and at altitudes corresponding to 5,000 m. Analysis of thermometric data revealed that at normal barometric pressure and 3% CO2 the skin and rectal temperatures during the first two days were within the limits of physiologic variations. Beginning with the third day there was an intensive increase in skin temperature primarily in the region of the distal parts of the extremities. At the same time there was a temperature increase in the rectum. With 4% CO2 there were no qualitatively different shifts in heat regulation. In a 5% hypercapnic medium the skin temperature increase began at the end of the first day. Subjects did not show an increase in rectal temperature. Experiments in the 6% range show temperature changes started the first day and were accompanied by a decrease in rectal temperature. Skin temperature remained virtually unchanged during this period. A normal pressures and 4% CO2, there was an increase in both skin and rectal temperature. At 5% CO2 rectal temperature did not increase and skin temperature increased insignificantly.
Author

N74-26585 Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF HUMAN GAS EXCHANGE IN A HYPEROXIC GAS MEDIUM AT NORMAL ATMOSPHERIC PRESSURE AND AT DIFFERENT AMBIENT TEMPERATURES
I. I. Antonov and I. R. Abramov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 147-149 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 323-325 (For availability see N74-26527 16-04)

Thermoregulatory shifts in the human body during hypoxia at different ambient temperatures were analyzed. The results revealed that under thermally neutral conditions during the first four hours of exposure there is a small increase in heat production. Later it begins to decrease gradually, attaining a maximum by the end of the first day. Under cold conditions the intensity of heat production during the first hours was more clearly expressed. Later it remained at the same level to the end of the experiment. At high ambient temperature there was no increase in heat production. At the end of the experiment when over heating occurred heat production increased. Skin temperature under the same condition did not show significant changes during a period of 18 to 20 hours. By the end of the first day skin temperature showed an intensive decrease. Under cold conditions, there was a marked decrease in skin temperature during the first hours, increasing as time passed. At high temperature at the very beginning of exposure there was an intensive increase in skin temperature. Author

N74-26586 Joint Publications Research Service, Arlington, Va.
EVALUATING THE FUNCTIONAL CAPABILITIES OF THE BODY UNDER THE COMBINED INFLUENCE OF EXTREMAL FACTORS
Ye. I. Sokolov, A. Ya. Tizul, Yu. S. Mdinaradze, and V. P. Khmelkov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 150-151 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 326-327 (For availability see N74-26527 16-04)

The functional, tolerances, and adaptive capabilities of the human body to prolonged space flight were evaluated. Body systems considered include the nervous, cardiovascular, endocrinal, immunobiologic. Definite changes were noted in the function of the nervous system, manifested in a lability of autonomic reflexes, thermotopography of the skin, cerebral bioelectric activity, decrease in amplitude of bioelectric reactions to light stimuli, and a tendency to an increase in the number of slow waves in the frontal parts of the brain. Other changes observed include: (1) increased systolic pressure and minute volume, and a decrease in specific peripheral resistance in some subjects, (2) increased systolic pressure and minute volume combine to cause an increase in histamine secretion, and (3) immunobiologic resistance decreased in the properdine level. Author

N74-26587 Joint Publications Research Service, Arlington, Va.
CHANGE IN THE BALLISTOCARDIOGRAM OF HEALTHY AND SICK PERSONS WHEN BREATHING OXYGEN AT INCREASED INTRAPULMONARY PRESSURES c05
I. P. Poleshchuk *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 152-154 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 330-332 (For availability see N74-26527 16-04)

A clinical analysis was made of the ballistocardiogram (BCG) of 24 healthy persons, 27 persons who had first stage hypertonia, 69 persons with initial symptoms of myocardial dystrophy of metabolic origin, and 41 patients with neurocirculatory dystonia of the hypersensitive type. At excess pulmonary pressure BCG indicies did not change significantly in either sick or healthy persons, and did not exceed normal limits. During inhalation, individuals with initial symptoms of cardiovascular disorders show no significant changes in BCG other than an increase in the LM segment for neurocirculatory dystonia and mycardiodystrophy individuals. During exhalation the BCG was greater in all groups studied. In patients with neurosecretary dystonia, there was an increase in KL intervals and a decrease in IJ amplitude, and JK segment; hypertonia patients show contraction of the J-K intervals and a decrease in amplitude of the corresponding agent. With myocardiodystrophy subjects, there was a decrease in I-J and J-K intervals and a decrease in the amplitude of HI, IJ, JK, and KL segments. Author

N74-26588 Joint Publications Research Service, Arlington, Va.
SANITARY-HYGENIC EVALUATION OF THE PROTECTIVE EFFECTIVENESS OF THE LEPESTOK MASK FOR FINELY DISPERSED AEROSOLS c05
L. N. Savelyev, A. M. Bulygina, M. V. Glushinskiy, and G. F. Kovygin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 155-156 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 333-334 (For availability see N74-26527 16-04)

The effectiveness of the Lepestok mask was investigated under conditions characterized by atmospheric contamination by finely dispersed aerosols whose concentration in individual cases exceed the maximum admissible concentration. The results of the investigations revealed that the effectiveness of air purification in 53% of the cases exceeded 90%, and in 16% of the cases attained 100%. However, in 26% of the cases the effectiveness did not exceed 75%. The mean weighted effectiveness was 87%. It should be noted that when the respirator was put on again the effectiveness was reduced for the first 30 to 60 minutes. In addition, it was discovered that there was a tendency toward an increase in respirator effectiveness in the case of increased aerosol concentration. Author

N74-26589# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FIRST IMAGES OBTAINED BY AUTO-TELEVISION OF THE HUMAN BODY USING ITS RADIATION IN THE MIDDLE INFRARED REGION
G. A. Boutry Apr. 1973 5 p ref Transl. into ENGLISH from J. Radiol., Electrol., Med. Nucl. (France), v. 48, 1967 p 24-26 (NTC-74-11927; Rept-73-123) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A television system operating in the vicinity of 3.5 micron wavelengths is briefly described, and infrared auto-television images of the human hand are discussed. F.O.S.

N74-26590*# Xavier Univ. of Louisiana, New Orleans. Dept. of Biology.
SOME CHARACTERISTICS OF FRUCTOSE 1,6-DIPHOSPHATASE ACTIVITY IN RAT LIVER
Portia U. Ashman, S. L. Lampkin, Lynette Dillon, and Rebecca Parks [1972] 31 p refs
(Grants NGR-19-007-004; RR-08008)
(NASA-CR-138599) Avail: NTIS HC $4.75 CSCL 06A

A reliable assay for hepatic fructose 1,6-diphosphatase in the rat was investigated. It was found that the greatest enzymic activity and highest protein levels were eluted from the colored portion of the homogenate. When the substrate concentration was 0.01M, the enzyme had optimal activity when incubated with 0.01M MgSO4 for 10 min. at 37 C in 0.05M Tris-HCL buffer, pH 7.5. Specificity for the substrate, fructose 1,6-diphosphate, was obtained at substrate concentration of 0.01M. Author

N74-26591*# Techtran Corp., Glen Burnie, Md.
CARDIAC OUTPUT AND OXYGEN INTAKE AT REST AND DURING SUBMAXIMAL LOADS ON 8-14 YEAR OLD BOYS
R. Mocellin, W. Sebening, and K. Buehlmeyer Washington NASA Jun. 1974 20 p refs Transl. into ENGLISH from Z. Kinderheilk. (Berlin), v. 114, 1973 p 323-339
(Contract NASw-2485)
(NASA-TT-F-15604) Avail: NTIS HC $4.00 CSCL 06P

Cardiac output, oxygen intake, and heart rate were investigated in 22 boys of ages 8 to 14 at rest and under application of two submaximal loads on the bicycle ergometer. The arteriovenous oxygen difference, stroke volume, and oxygen intake per kilogram of body weight were calculated from the measured values. The measured values were compared with values recorded in other studies with adults and older children and with the values expected on the basis of theory. Author

N74-26592*# California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
ENZYME ACTIVITY IN TERRESTRIAL SOIL IN RELATION TO EXPLORATION OF THE MARTIAN SURFACE Final Report
A. D. McLaren 30 Jun. 1974 5 p refs
(Grant NGL-05-003-079)
(NASA-CR-138587) Avail: NTIS HC $4.00 CSCL 06M

Sensitive tests for the detection of extracellular enzyme activity in Martian soil was investigated using simulated Martian soil. Enzyme action at solid-liquid water interfaces and at low humidity were studied, and a kinetic scheme was devised and tested based on the growth of microorganisms and the oxidation of ammonium nitrite. M.C.F.

N74-26593*# Hawaii Univ., Honolulu. Botany Dept.
TOXICOLOGY: MECHANISMS OF DEUTERIUM OXIDE ACTION, PART 2 Semiannual Report
S. M. Siegel Dec. 1973 52 p refs
(Grant NGL-12-001-042)
(NASA-CR-138616; Paper-35) Avail: NTIS HC $5.75 CSCL 06T

The metabolism of winter rye seedlings (Secale cereale, L. cv. Winter) cultured in 99.6% D2O was investigated. Compared with water grown seedlings, the protein content was much lower in the D2O cultured seedlings and the incorporation of H(3)-leucine and H(3)-phenylalanine into medium to high molecular weight proteins was partially blocked. The synthesis of the enzyme peroxidase was also reduced in the D2O plants. Seedlings cultured in D2O incorporate H(3)-thymidine into DNA, but do not take up H(3)-uridine. These results suggest that some of the toxic effects of D2O culture on higher plants can be attributed to a partial block of protein synthesis. Author

N74-26594*# Techtran Corp., Glen Burnie, Md.
THE EFFECT OF FACTORS RELATED TO THE CONQUEST OF SPACE
P. V. Vasilyev, A. R. Kotovskaya, P. D. Gorizontov, ed., and N. N. Sirotinin, ed. Washington NASA Apr. 1974 37 p refs Transl. into ENGLISH from the book "Patologicheskaya Fiziologiya Ekstremalnykh Sostoyaniy" Moscow, Meditsina Press, 1973 p 290-312
(Contract NASw-2485)
(NASA-TT-F-15322) Avail: NTIS HC $5.00 CSCL 06P

A review was conducted of the available literature and some original findings on the effect of two forms of accelerations on human and animal organisms. The accelerations dealt with the transverse and longitudinal accelerations. The most poorly tolerated type of acceleration with respect to man is the longitudinal form directed from head to seat. This form of acceleration causes acute redistribution of blood from the upper part of the body to the lower abdomen and the extremities, causing severe hypoxic disorders in the brain, disruption of vision and loss of consciousness. Various methods have been tried in order to reduce the adverse effects of acceleration on the human body. Much promise is attached to these methods of increasing man's endurance to g-forces, however, there are yet many questions of the effect of g-forces on the organism which require answers. Author

N74-26595*# Kanner (Leo) Associates, Redwood City, Calif.
THE FOURTH NATIONAL CONFERENCE ON ACOUSTICS. VOLUME 3: PHYSIOLOGICAL, PSYCHOLOGICAL AND BIOLOGICAL ACOUSTICS
Washington NASA Mar. 1974 176 p refs Transl. into ENGLISH of the publ. "A IV-a Conferinta Nationala de Acustica. Volume 3: Acustica Fiziologica, Psihologica si Biologica" Bucharest, Acad. of the Socialist Republic of Romania, 29-31 May 1973 237 p
(Contract NASw-2481)
(NASA-TT-F-15774) Avail: NTIS HC $12.00 CSCL 06S

Medical, social, psychological, and physiological problems raised by noise pollution are reported. Medical aspects of airport noise, noise induced hearing losses in various industries and noise annoyance are discussed. There are also several articles on the biophysical and medical effects of ultrasounds. Author

N74-26596# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 8, NO. 2, 1974
24 May 1974 146 p refs Transl. into ENGLISH of Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 3-90
(JPRS-62082) Avail: NTIS HC $10.50

Articles are presented concerning the selection and training of cosmonauts; evaluation and analysis of accumulated data to facilitate the on-going transition from orbital to interplanetary flights; research aimed at guaranteeing safety on long flights and reliability of the human component of the man-spaceship system; space psychology and physiology; environmental problems and control (spacecraft habitability, effects of radiation and weightlessness) and telemetry. For individual titles, see N74-26597 through N74-26615.

N74-26597# Joint Publications Research Service, Arlington, Va.
CYTOLOGICAL AND CYTOGENETIC EFFECTS IN THE CELLS OF BACTERIA AND MAMMALS UNDER THE INFLUENCE OF ACCELERATED HEAVY IONS
Yu. G. Grigoryev, N. I. Ryzhov, B. S. Fedorenko, Ye. A. Krasavin, S. V. Vorozhtsova, L. A. Koshcheyeva, N. Ya. Savchenko, and V. F. Khlaponina *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 1-8 refs Transl. into ENGLISH from Kosmich. Biol. i Aviatkosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 3-8 (For availability see N74-26596 16-04)

Studies were made of the biological effectiveness of

post-radiation recovery processes and factors modifying radiological effects brought about by the action of heavy ions and standard radiations on bacterial E. coli B cells and mammalian cells. Heavy ions exhibited a more pronounced biological effect. Bacterial and mammalian cells exhibited somewhat similar responses to radiations with high linear energy losses (LEL). This is suggested by a similarity in the direction and picture of damage. There were also significant qualitative and quantitative differences related to the species and organization of the biological objects tested. This applies mainly to the different relationships between the relative biological effect changes and LEL. Author

N74-26598# Joint Publications Research Service, Arlington, Va.

EFFECT OF HYPOKINESIA ON THE LIPID COMPOSITION OF THE BLOOD AND TISSUES IN RABBITS OF DIFFERENT AGES

Yu. P. Rylnikov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 9-15 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 8-13 (For availability see N74-26596 16-04)

Rabbits of two groups (older animals aged 2-2 1/2 years weighting 3.5 to 5.0 kg and younger animals aged 1-1 1/2 years weighing 2.5 to 3.0 kg) were confined in small cages. The exposure was accompanied by an increase in cholesterol in the blood, heart and liver. This increment was greater in animals of the older group. This was clearly expressed in the liver tissue (fivefold increase). The level of total lipids in the heart and liver increased, conforming to the same pattern. The content of phosphatids in the heart and aorta decreased at the expense of sphingomyelins, lecithin and kephalin in the older group and at the expense of lecithin and kephalin in the younger group. The dropoff in oxygen consumption was more clearly expressed in the older group. Accordingly, hypokinetic exposure in older age groups favors the development of atherosclerosis. Author

N74-26599# Joint Publications Research Service, Arlington, Va.

CELL CHANGES IN RAT LIVERS DURING HYPOKINESIA

S. Ye. Li and O. I. Kirillov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 16-23 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 13-17 (For availability see N74-26596 16-04)

Male rats of the Wistar line weighing 95-100 g were kept under hypokinetic conditions. Five to nine test and control animals were sacrificed after 12 hours, two, six, nine, and 14 and 19 days. The nuclear size, mitotic index and number of binucleate cells in the liver were determined. During hypokinesia the absolute weight of the liver decreased whereas its relative weight increased. Nuclear polidy decreased, the mitotic index declined and the number of binucleate cells more than doubled. It is assumed that some polyploid cells are transformed into binucleate cells which in turn are divided into mononuclear diploid cells. Author

N74-26600# Joint Publications Research Service, Arlington, Va.

HYDROGEN BACTERIA AS A POSSIBLE SOURCE OF PROTEIN IN FOOD FOR MAN AND ANIMALS

V. I. Fofanov, V. K. Kovalenkova, I. T. Troitskaya, L. A. Siletskaya, A. V. Novikova, and L. V. Vasilyeva *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 24-28 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 17-20 (For availability see N74-26596 16-04)

A study was made of the nutritional value of proteins from a biomass of hydrogen bacteria Hydrogenomonas eutropha of the Z-1 group on a Schlegel medium in Vedenina's modification. Before feeding animals the polymer of beta-hydroxybutyric acid was extracted with chloroform. A high biological value of the proteins from the biomass of hydrogen bacteria was demonstrated. Further investigations of the biochemical composition of the biomass are needed with respect to the changes noted in kidney tissues. Author

N74-26601# Joint Publications Research Service, Arlington, Va.

EFFICIENCY IN USING THE PRODUCTS OF FORMALDEHYDE CONDENSATION IN THE SYNTHESIS OF CARBOHYDRATES

V. A. Uspenskaya and G. M. Petrova *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 29-35 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 20-24 (For availability see N74-26596 16-04)

The catalytic activity of synthetic carbohydrates formed during formaldehyde condensation was investigated. It was experimentally demonstrated that the formaldehyde condensate which was not treated with sorbents exhibited a higher capacity for activating the reaction of formaldehyde condensation to sugars. The efficiency of an organic cocatalyst increased substantially when a half-condensate was used in its place. This may help to reduce energy requirements and to bring about mild conditions for the synthesis. Author

N74-26602# Joint Publications Research Service, Arlington, Va.

SYNTHESIS OF METHYL ALCOHOL FROM CO2 AND H2 AS AN INTERMEDIATE PRODUCT OF CARBOHYDRATE PRODUCTION

M. G. Rozenfeld, M. T. Rusov, S. K. Sachenko, and Yu. Ye. Sinyak *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 36-42 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 24-28 (For availability see N74-26596 16-04)

Parameters are given of methanol synthesis which provide the maximum level of carbon dioxide and hydrogen conversion and the maximum yield of methanol as an intermediate product of carbohydrate regeneration in a small enclosure. The maximum yield of methanol takes place when there is a stoichiometric ratio of the initial components. The maximum degree of gas utilization is dependent on their concentration in the initial medium. Author

N74-26603# Joint Publications Research Service, Arlington, Va.

PECULIARITIES OF REACTION OF THE RAT CEREBELLUM TO EXPOSURE TO CENTRIPETAL ACCELERATIONS AFTER PROLONGED HYPOKINESIA

L. D. Klimovskaya and N. P. Smirnova *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 43-51 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 29-34 (For availability see N74-26596 16-04)

White rats kept under conditions of prolonged hypokinesia were exposed to transverse accelerations of 6 and 10 g. In acute experiments the induced activity of the cerebellar cortex was investigated in Nembutalanesthesized rats before, during and after rotation on a centrifuge. The amplitude of the electric response of the cerebellar cortex to stimulation of the sciatic nerve was found to increase on the 14th day of hypokinesia; later the induced potential did not differ from the control. The cerebellar response to acceleration, which was measured with respect to inhibition of the induced potential, decreased on the 35th-40th days of hypokinesia and increased on the 55th-60th days. A decrease in kinesthetic afferentation and a general increase in excitation due to stress effects contributed to the development of functional disorders in the cerebellar cortex during hypokinesia. Author

N74-26604# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF CIRCULATORY INDICES IN THE CREW OF THE SALYUT ORBITAL STATION DURING AN EXAMINATION UNDER REST CONDITIONS

V. A. Degtyarev, V. G. Doroshev, N. D. Kalmykova, Z. A. Kirillova, and N. A. Lapshina *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 52-64 refs Transl. into ENGLISH from Kosmich. Biol. i Avtiakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 34-42 (For availability see N74-26596 16-04)

Results are given of complex investigations of blood circulation

for the crew of the Salyut orbital station under hypokinetic conditions. It was found that the levels of arterial pressure, blood outputs, work and intensity of contraction of the left ventricle were relatively high. Despite a certain similarity to model experiments, the dynamics of the principal indices of circulation during weightlessness has its specific peculiarities. The syndrome of shortening of the phase of isovolumetric contraction of the left ventricle, a considerable amplitude of fluctuations of individual indices during repeated investigations, and an influence of accompanying factors associated with the crew's current activity aboard the station on the dynamics of circulation can be observed. Analysis of data in dependence on times of exposure to weightlessness did not exhibit a clear tendency in the change of most of the registered indices which could be related to the cumulative effect of weightlessness. Author

N74-26605# Joint Publications Research Service, Arlington, Va.

SOME PROBLEMS IN INTERACTION BETWEEN THE VESTIBULAR AND VISUAL ANALYZERS

A. Ye. Kurashvili and V. I. Babiyak *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 65-75 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 42-50 (For availability see N74-26596 16-04)

A study was made of the influence of the vestibular analyzer on fixation and tracking motions of the eye. Stimulation of the vestibular apparatus was accomplished by the rotation and calorization methods: oculomotor reactions were registered using an improved electrooculogram method. The problem of visual perception of space coordinates and its modification under the influence of rotation and electric stimulation of the vestibular apparatus was studied. The conclusion was drawn that the vestibular system, as a system sensing extrasubjective gravitational space constants, is most important in the formation of visual concepts of space coordinates. These concepts are reflected in the objective characteristics of oculomotor reactions. Author

N74-26606# Joint Publications Research Service, Arlington, Va.

CLINICAL-PHYSIOLOGICAL ASPECTS OF EARLY FORMS OF AUTONOMIC-VASCULAR DISORDERS

A. Ya. Tizul and E. I. Matsnev *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 76-82 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 50-54 (For availability see N74-26596 16-04)

Examinations of 71 persons with polymorphous autonomic-vascular disturbances allowed clinical and physiological characterization of early forms of the dysfunctions which develop in so-called clinically healthy persons in the age group 25-40 years. Autonomic disorders occurred in 33.8% of the intellectuals who were not regularly engaged in physical work or sports. Most patients with various mild clinical manifestations of autonomic dysfunctions exhibited a decline in the range of adaptive and compensatory capabilities of the human body which is manifested in an unsatisfactory tolerance to functional tests. In a small percentage of cases (12%) autonomic vascular dystonia was diagnosed mainly in relation to autonomic disturbances observed during functional tests. Author

N74-26607# Joint Publications Research Service, Arlington, Va.

CHANGES IN THE ELECTROCARDIOGRAM DURING ACUTE HYPOXIA AND THEIR SIGNIFICANCE

V. B. Malkin and V. I. Plakhatnyuk *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 83-92 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 54-61 (For availability see N74-26596 16-04)

The use of hypoxic hypoxia (ascent to an altitude of 5,000 m in a normal atmosphere) as a provocative test for detecting latent cardiac pathology is described and summarized. In 12,000 tests during which electrocardiographic studies were made of healthy male test subjects and subjects with neurocirculatory pystonia, in the age group 20-45 years, 3.66% of the cases exhibited ECG changes which were beyond the normal limits (conditionally pathological changes). In 82.93% of the cases conditionally pathological changes in the ECG were related to various disorders in the cardiac rhythm. Two categories of disorders were distinguished: (1) those developing together with the functional inadequacy of regulation of circulation during the hypoxic test and determining reduced tolerance to hypoxia, and (2) rhythm disorders producing no effect on altitude tolerance. Author

N74-26608# Joint Publications Research Service, Arlington, Va.

EFFECT OF AN INCREASED CARBON DIOXIDE CONTENT ON THE PHAGOCYTIC ACTIVITY OF NEUTROPHILS AND THE LEVEL OF SIALIC ACIDS IN THE HUMAN BLOOD

M. V. Markaryan *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 93-96 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 61-63 (For availability see N74-26596 16-04)

A five-day exposure of man to an increased (3-5%)carbon dioxide concentration in a small sealed chamber inhibited the phagocytic activity of neutrophils and reduced the level of sialic acids in the blood serum. A correlation was established between the carbon dioxide content in the inhaled air and the level of changes in the mentioned parameters. The highest level of phagocytic inhibition and decrease in sialic acid occurred when breathing a 5% carbon dioxide atmosphere. Author

N74-26609# Joint Publications Research Service, Arlington, Va.

STUDY OF ORGANIZATION OF A FLIER'S ATTENTION DURING INSTRUMENT FLIGHT

I. D. Malinin and V. A. Ponomarenko *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 97-102 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 64-68 (For availability see N74-26596 16-04)

An attempt was made to examine the phenomenon of switching of attention during instrument flight from the point of view of probability theory. For solving the formulated problem the investigation used the method of evaluation of the distribution of attention of a flier from instrument to instrument using a concealed motion picture survey of the pilot's eyes. This enabled the observer to trace the movement of the flier's glance directly in flight in a trainer through an optical light conductor without distracting the flier's attention from piloting tasks. The motion picture films were interpreted using keys which represent the image of the fixed glance of the flier at the time of fixation of the eyes on each of the piloting-navigational instruments. Computations give every basis for assuming that the function of distribution and switching of attention of a flier during instrument flight is a determined and organized form of mental behavior of a flier in the aircraft control process. Author

N74-26610# Joint Publications Research Service, Arlington, Va.

EVALUATION OF THE FUNCTIONAL STATE OF THE MYOCARDIUM IN FLIGHT PERSONNEL DETERMINED FROM CLINICAL-INSTRUMENTAL INVESTIGATIONS

V. M. Kondrakov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 103-107 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 68-71 (For availability see N74-26596 16-04)

Electrocardiographic changes, polycardiographic and hemodynamic parameters were analyzed in 146 pilots in the age group 39-57. With respect to ECG changes, the subjects (in the second group) with diffuse ECG changes exhibited a phasic hypodynamic syndrome, a decrease in cardiac output, strength and output of the left ventricle. Thirty percent of the first-group subjects with a normal ECG exhibited changes in the early systolic phases, the energy parameters of cardiac activity indicating an inadequate contractability of the cardiac muscle. A comparative analysis of these changes helps in an objective evaluation of the functional capabilities of the cardiovascular system, in formulating a proper diagnosis of the disease, and in recommending rational treatment, as well as in making a well-substantiated expert decision. Author

N74-26611# Joint Publications Research Service, Arlington, Va.

PRINCIPLES IN FORMULATING OPTIMUM SLEEP AND WAKEFULNESS REGIMES FOR MAN DURING PROLONGED SPACE FLIGHTS

A. N. Litsov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 108-115 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 71-75 (For availability see N74-26596 16-04)

The main steps which can be taken to prevent unfavorable responses of cosmonauts to changes in work-rest schedules are: development of optimum schedules, their good agreement with the biorhythmological peculiarities of every crew member, and preliminary adaptation of cosmonauts to the new cycle under favorable conditions on the earth. The optimum regimes are the routine regimes to which man normally adheres. Relatively optimum regimes are those which provide a rapid but incomplete rearrangement of the cycle. Nonoptimum regimes are those which are not followed by a synchronization of the basic functions of the human body and the altered environment. The optimum level of the diurnal cycle is dependent to a certain extent on the duration of sleep and wakefulness periods, their change and fractionation, distribution of work and rest, etc. During space flight static 24-hour cycles seem to be the best. Author

N74-26612# Joint Publications Research Service, Arlington, Va.

AUTOMATIC MODELING OF SATURATION AND DESATURATION PROCESSES IN THE BODY BY AN INERT GAS WITH A CHANGE IN PRESSURE

M. V. Propp *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 116-126 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 75-82 (For availability see N74-26596 16-04)

A decrease in pressure of an atmosphere containing inert gases can cause different types of decompression disorders. The author examines methods for the automatic modeling of the process of saturation and desaturation of the body by an inert gas with a change in pressure using analog elements in which the gas is diffused through a porous barrier. The pressure change beyond the porous barrier corresponds to the pressure change in a definite group of tissues. Use of automatic computations with analog devices makes it possible to employ the optimum pressure decrease regime, shortens decompression time and makes it possible to avoid computations from tables. The instruments can be used in diving, caisson work, in high altitude and space flights. Author

N74-26613# Joint Publications Research Service, Arlington, Va.

POSSIBILITIES OF USING A PHARMACOLOGIC AUTONOMIC BLOCKAGE (GANGLIOPLEGIA) IN AVIATION AND COSMONAUTICS

F. Smolyarek *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 127-132 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 83-85 (For availability see N74-26596 16-04)

The effect of ganglioplegia for the prevention and treatment of damage which can arise in response to extremal factors in aviation and space flights was studied. Pharmacologic preparations which cause an autonomic blockade have been used for a long time, but without taking their ganglioplegic effect into account. These drugs include novocain and its derivatives and curare. Ganglioplegia came into use in 1946 (tetraethylammonium). Later such substances as hexamethonium, vegolysen, pantholin, homotrophine, dicolin, pendiomid, arfonad, and ecolid came into use. Since ganglioplegic drugs operate ampholytically they inhibit the functioning of the more stressed part of the autonomic nervous system, this is accompanied by general calming, a decrease in secretion of catechol amines, a change in microcirculation, and some tendency to gravitational blood movement. The latter is one of the few factors limiting use of ganglioplegia in aviation and cosmonautics and requires further investigations. Author

N74-26614# Joint Publications Research Service, Arlington, Va.

EFFECT OF PROTAMINE-ADENOSINETRIPHOSPHATE ON THE VIABILITY OF LETHALLY IRRADIATED RATS

T. P. Pantev, N. V. Bokova, and I. T. Nikolov *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 133-135 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 85-86 (For availability see N74-26596 16-04)

Data are presented on the synthesis of protamine-adenosinetriphosphate (PATP) and the results of an experimental study of its antiradiation properties. Author

N74-26615# Joint Publications Research Service, Arlington, Va.

INVESTIGATIONS IN THE FIELD OF AVIATION MEDICINE AT THE MILITARY-MEDICAL ACADEMY IMENI S. M. KIROV (ON THE 175TH ANNIVERSARY OF THE MILITARY-MEDICAL ACADEMY IMENI S. M. KIROV)

G. I. Gurvich and Z. K. Sulimo-Samuyllo *In its* Space Biol. and Aerospace Med., Vol. 8, No. 2, 1974 (JPRS-62082) 24 May 1974 p 136-143 refs Transl. into ENGLISH from Kosmich. Biol. i Aviakosmich. Med. (Moscow), v. 8, no. 2, Mar.-Apr. 1974 p 86-90 (For availability see N74-26596 16-04)

Development of aviation medicine in the Soviet Union is briefly reviewed along with specific examples of Soviet successes in aerospace medicine. A.L.

N74-26616*# Childrens Hospital Research Foundation, Washington, D.C.

INVESTIGATION OF THE EFFECT OF STRESS ON THE CHEMISTRY, METABOLISM, AND BIOPHYSICS OF COLLAGEN Final Report

John C. Houck 30 Aug. 1973 6 p

(Grant NGR-09-134-001)

(NASA-CR-138591) Avail: NTIS HC $4.00 CSCL 06A

The research is reported concerning the effect of stress on the chemistry in the connective tissue of the rat. It was found that within a day after administration of cortisol (stress harmone), a significant amount of the insoluble collagen dissappeared from the skin. It is concluded that the abrupt catabolism of cutaneous collagen releases peptides. These peptides are rapidly degraded to free amino acids which are active in effecting liver glycogen synthesis, and provide a major energy source to assist the animal in the fight or flight reaction. It is proposed that cutaneous collagen represents a reserve energy pool, which can be mobilized via stress harmones. F.O.S.

N74-26617*# Scientific Translation Service, Santa Barbara, Calif.

FUNCTIONS OF THE CENTRAL NERVOUS SYSTEM UNDER THE COMBINED EFFECT OF STRESS FACTORS: IONIZING RADIATION, ACCELERATIONS AND VIBRATION

N. N. Livshits, ed. Washington NASA Apr. 1974 202 p refs Transl. into ENGLISH of the book "Funktsii Tsentralnoy Nervnoy Sistemy pri Kombinirovannom Deystvii Stress-Faktorov (Ioniziruy-ushchey Radiatsii, Uskoreniy i Vibratsii" Moscow, Nauka Press, 1973 p 1-174

(Contract NASw-2483)

(NASA-TT-F-15363) Avail: NTIS HC $13.25 CSCL 06P

This collection presents experimental studies of the combined effect of dynamic factors (acceleration and vibration) and ionizing radiation on the functional state of the vestibular analysor, higher nervous activity and animal behavior. The article summarizing the results of these and previously published works substantiates the theory of the importance of intracentral processes in the reactions of the central nervous system to applied combined forces. The collection also includes studies of the importance of changes in oxidizing metabolism in brain tissues in modifying action on radiation. Author

N74-26618# Joint Publications Research Service, Arlington, Va.

COSMONAUT FLIGHT PREPARATION

A. Nikolayev 24 May 1974 20 p Transl. into ENGLISH from Krylya Rodiny (Moscow), no. 2, Feb. 1974 p 10-4 and no. 3, Mar. 1974 p 10-13

(JPRS-62083) Avail: NTIS HC $4.00

Replies to questions on cosmonaut training and the design and layout of the Soyuz ship are presented. Author

N74-26619*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPROVED METHOD OF DETECTING AND COUNTING BACTERIA Patent Application
Grace L. Picciolo and Emmett W. Chappelle, inventors (to NASA) Issued 31 May 1974 20 p
(NASA-Case-GSC-11917-1; US-Patent-Appl-SN-475337) Avail: NTIS HC $4.00 CSCL 06M

A method for bacteria counting and detection is described. The problems solved by the equipment are identified as: (1) the lack of recognition that a quantity of nonbacterial ATP was bound to large molecules of particulate matter and would not be destroyed by apyrase unless freed, as in this case by a suitable buffer such as malic acid and (2) the sensitivity or lack of capability of a system to detect and count low bacteria levels. The solution was to concentrate the sample, by centrifuging for example, so that the ATP would effectively stand apart from the supernatant phase. NASA

N74-26620*# Kanner (Leo) Associates, Redwood City, Calif.
AQUATIC PLANT SURVIVES IN SIMULATED JOVIAN ATMOSPHERE. FIRST STUDIES CONCERNING THE ASSIMILATION OF C-14 METHANE BY ELODEA CANADENSIS
E. R. Koch Washington NASA Jun. 1974 6 p refs Transl. into ENGLISH from "Preprints of Lectures from the International Congress on Aviation and Space Medicine (21st)" Munich, 1973 p 117-118
(Contract NASw-2481)
(NASA-TT-F-15718) Avail: NTIS HC $4.00 CSCL 06C

Aquatic plants, Elodea canadensis, were kept in a reducing C-14 atmosphere. At the end of the experiments, radioactivity could be detected in the plants and in several intermediate metabolic products. Light induced incorporation of C-14h4 from methane in Elodea is concluded to be very probable on the basis of these preliminary studies. Author

N74-26621*# Catholic Univ. of America, Washington, D.C. Dept. of Biology.
EFFECTS OF MUTATION AND SOME ENVIRONMENTAL FACTORS ON THE PHYSIOLOGY AND PATHOGENICITY OF SELECTED BACTERIA Final Report, 1 Oct. 1972 - 30 Sep. 1973
Benedict T. DeCicco 10 Jun. 1974 9 p refs
(Grant NGR-09-005-098)
Avail: NTIS HC $4.00 CSCL 06M

Studies with mutants of Staphylococcus aureus lacking some virulence factors suggest that the presence of deoxyribonuclease correlates with mouse pathogenicity of S. aureus, while the ability to ferment mannitol or the possession of coagulases are not required for virulence. Autotrophy investigations on mycobacteria demonstrate a complete correlation between the ability to grow with hydrogen and the species of scotochromogenic mycobacterium tested. All tested strains of M. gordonae, a saprophyte, could grow autotrophically while none of the tested strains of M. scrofulaceum, a clinically important species, possessed this ability. A series of heat tolerant mutants of Pseudomonas fluorescenes were obtained which can grow at temperatures up to 54 C, in contrast to a maximum growth temperature of 37 C for the wild type. Author

N74-26622# Royal Aircraft Establishment, Farnborough (England).
THE INFLUENCE OF AN ORAL ADMINISTRATION OF GLUCOSE ON HUMAN CARBOHYDRATE AND FAT METABOLISM DURING WORK, WITH PARTICULAR REGARD TO MUSCLE GLYCOGEN
D. Muller-Wening, W. Ehrenstein, G. Hoffmann, and M. Kretschmer Feb. 1973 17 p refs Transl. into ENGLISH from Res. Exp. Med. (Heidelberg), v. 157, no. 4, 1972 p 325-335
(RAE-Lib-Trans-1702; BR37565) Avail: NTIS

Glycogen content of muscle, blood glucose, insulin, FFA, RQ, and lactate were investigated in 18 male subjects during 2 hours' work on bicycle ergometer corresponding to 50% of the V02 maximum. After work periods of 10 and 30 minutes, no significant change in glycogen content was observed, while after 2 hours a significant decrease of 2.10 g per 100g dry weight was found. During work the utilization of carbohydrates decreased, fatty oxidation increased. Continuous oral glucose application reduced the fall of glycogen. After 30 minutes there was an insignificant difference of 0.55 g%, after 2 hours 0.26 g%. The utilization of carbohydrates was increased and did not show any change during the work period. A micro-method is described for the determination of the glycogen content of specimens of human skeletal muscle. Author

N74-26623# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF ADAPTATION TO COLD ON THE ENERGY OF MUSCULAR ACTIVITY
Yu. I. Bazhenov Apr. 1974 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 208, no. 5, 1973 p 1250-1252
(RAE-Lib-Trans-1749; BR41242) Avail: NTIS HC $4.00

Evidence is presented of increase and mechanism of increase in heat produced from muscles of rats secondary to cold adaption. Author

N74-26624# Naval Submarine Medical Research Lab., Groton, Conn.
EVIDENCE FOR A POSSIBLE MEMORY IMPAIRMENT RESULTING FROM NITROGEN NARCOSIS IN THE RHESUS MONKEY Medical Research Progress Report
Raymond T. Bartus 30 Aug. 1973 10 p refs
(MF51524004)
(AD-775871; NSMRL-751) Avail: NTIS CSCL 05/10

Three Rhesus monkeys were pressurized to 200 feet simulated depth and tested on the reversal of a previously trained visual distrimination problem. All three monkeys displayed a higher percentage of errors on this reversal problem then on another reversal problem tested on the surface. These data, supplemented by changes in the monkeys: post-response stimulus observation time, are interpreted as possible evidence for memory impairments resulting from nitrogen narcosis. Author (GRA)

N74-26891 Joint Publications Research Service, Arlington, Va.
NONSTATIONARY MODEL OF WATER-HEAT REGIME OF VEGETATION COVER
O. D. Sirotenko *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 107-118 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 89-97
(For availability see N74-26880 16-13)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-26625* National Aeronautics and Space Administration. Pasadena Office, Calif.
MINIATURE MULTICHANNEL BIOTELEMETER SYSTEM Patent
John B. Carraway (JPL) and Joe T. Sumida, inventors (to NASA) (JPL) Issued 4 Jun. 1974 9 p Filed 5 Jul. 1972 Sponsored by NASA
(NASA-Case-NPO-13065-1; US-Patent-3,815,109; US-Patent-Appl-SN-269073; US-Patent-Class-340-207R; US-Patent-Class-128-2.1A; US-Patent-Class-325-113; US-Patent-Class-325-141; US-Patent-Class-340-183; US-Patent-Class-340-203) Avail: US Patent Office CSCL 06B

A miniature multichannel biotelemeter system is described. The system includes a transmitter where signals from different sources are sampled to produce a wavetrain of pulses. The transmitter also separates signals by sync pulses. The pulses amplitude modulate a radio frequency carrier which is received at a receiver unit. There the sync pulses are detected by a demultiplexer which routes the pulses from each different source to a separate output channel where the pulses are used to

reconstruct the signals from the particular source.
Official Gazette of the U.S. Patent Office

N74-26626* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPARATUS AND METHOD FOR PROCESSING KOROTKOV SOUNDS Patent
Donald P. Golden (Technol., Inc., Houston, Tex.), George W. Hoffler (Technol., Inc., Houston, Tex.), and Roger A. Wolthuis, inventors (to NASA) (Technol., Inc., Houston, Tex.) Issued 4 Jun. 1974 9 p Filed 24 May 1972 Sponsored by NASA
(NASA-Case-MSC-13999-1; US-Patent-3,814,083; US-Patent-Appl-SN-256317; US-Patent-Class-128-2.05A; US-Patent-Class-128-2.05S) Avail: US Patent Office CSCL 06B

A Korotkov sound processor, used in a noninvasive automatic blood measuring system where the brachial artery is occluded by an inflatable cuff, is disclosed. The Korotkoff sound associated with the systolic event is determined when the ratio of the absolute value of a voltage signal, representing Korotkov sounds in the range of 18 to 26 Hz to a maximum absolute peak value of the unfiltered signals, first equals or exceeds a value of 0.45. Korotkov sound associated with the diastolic event is determined when a ratio of the voltage signal of the Korotkov sounds in the range of 40 to 60 Hz to the absolute peak value of such signals within a single measurement cycle first falls below a value of 0.17. The processor signals the occurrence of the systolic and diastolic events and these signals can be used to control a recorder to record pressure values for these events.
Official Gazette of the U.S. Patent Office

N74-26627*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
HYDROGEN DEPOLARIZED CELL PAIR DEFINITION FOR SPACE STATION APPLICATION Final Report
Cornelius R. Russell Mar. 1973 150 p
(Contract NAS9-12920)
(NASA-CR-134291; SVHSER-6229) Avail: NTIS HC $10.50 CSCL 10A

Evaluation testing of the cell pair design of an electrochemical carbon dioxide collection subsystem was conducted. The system is proposed for use with the space station prototype. The objectives of the analytical and miscellaneous tasks in support of the test program are explained. An analysis was made of the number of cells required for the space station prototype. It was determined that 33 cell pairs would satisfy the space station prototype performance. Author

N74-26628*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
NEW TECHNIQUES FOR THE ANALYSIS OF MANUAL CONTROL SYSTEMS Final Technical Report, 15 Jun. 1965 - 15 Jun. 1971
George A. Bekey 15 Jun. 1971 29 p refs
(Grant NGR-05-018-022)
(NASA-CR-138515) Avail: NTIS HC $4.50 CSCL 05E

Studies are summarized on the application of advanced analytical and computational methods to the development of mathematical models of human controllers in multiaxis manual control systems. Specific accomplishments include the following: (1) The development of analytical and computer methods for the measurement of random parameters in linear models of human operators. (2) Discrete models of human operator behavior in a multiple display situation were developed. (3) Sensitivity techniques were developed which make possible the identification of unknown sampling intervals in linear systems. (4) The adaptive behavior of human operators following particular classes of vehicle failures was studied and a model structure proposed.
D.L.G.

N74-26629*# Denver Research Inst., Colo.
DIRECT OXIDATION OF STRONG WASTE WATERS, SIMULATING COMBINED WASTES IN EXTENDED-MISSION SPACE CABINS Final Report
Laurence W. Ross 30 Apr. 1973 10 p refs
(Grant NGR-06-004-068)
(NASA-CR-138607) Avail: NTIS HC $4.00 CSCL 06I

The applications of modern technology to the resolution of the problem of solid wastes in space cabin environments was studied with emphasis on the exploration of operating conditions that would permit lowering of process temperatures in wet oxidation of combined human wastes. It was found that the ultimate degree of degradation is not enhanced by use of a catalyst. However, the rate of oxidation is increased, and the temperature of oxidation is reduced to 400 F. F.O.S.

N74-26630# Royal Aircraft Establishment, Farnborough (England).
ASSESSMENT OF ORGANISM EFFICIENCY WHILE WORKING IN BREATHING APPARATUS
Teresa Comte May 1973 20 p refs Transl. into ENGLISH from Prace Central. Inst. Ochrony Pracy (Warsaw), v. 21, no. 71, 1971 p 319-333
(RAE-Lib-Trans-1699; BR36225) Avail: NTIS HC $4.00

The following types of respiratory protective equipment were evaluated: (1) A mask type MA-1 fitted with a hydrogen cyanide absorber; (2) an apparatus type LA; and (3) a protective apparatus for sand blasting workers. Investigations carried out in industrial establishments were concerned with the following physiological indices: pulse rate, arterial blood pressure, minute pulmonary ventilation, frequency and volume of breathing, energy expenditure and face skin temperature. In laboratory investigations, additional factors considered were: temperature and humidity in the breathing apparatus dead space, pH and pCO2 of blood. Author

N74-26631# Committee on Commerce (U. S. Senate).
AIR BAG DEVELOPMENT AND TECHNOLOGY
Washington GPO 1973 174 p refs Hearing before Comm. on Com., 93d Congr., 1st Sess., 1 Aug. 1973
(GPO-23-080) Avail: Comm. on Com.

The status of air bag technology and development is considered. Emphasized are safety measure to prevent injuries in automobile accidents. G.G.

N74-26632# Advisory Group for Aerospace Research and Development, Paris (France). Aerospace Medical Panel.
HELICOPTER AIRCREW FATIGUE
I. C. Perry, ed. May 1974 25 p refs
(AGARD-AR-69) Avail: NTIS HC $4.25 CSCL 05E

A study was conducted to provide: (1) a definition of aviator fatigue, (2) a list of the effects of fatigue on operational effectiveness, (3) a statement of causal factors and diagnostic criteria, (4) a statement of preventive measures, and (5) a statement of methods of treatment of aviator fatigue. These specific aims were accomplished and are presented. In addition, the results are given of an aircrew opinion questionnaire and a review of 120 helicopter accidents. D.L.G.

N74-26633# Royal Aircraft Establishment, Farnborough (England).
HUMAN FACTORS IN THE STUDY OF INFORMATION INPUT DEVICES
J. C. Sperandio and Aj Bisseret Mar. 1974 41 p refs Transl. into ENGLISH from Coll. du CERP (France), v. 17, no. 4, 1968 p 269-294
(RAE-Lib-Trans-1728; BR41239) Avail: NTIS HC $5.25

One problem area in man machine systems is that of communication between man and machine. A good knowledge of the various communication devices and of their compatibility with the operator is therefore very useful when preparing the optimization of a working system. Keyboard and comparisons based on speed, accuracy, ease of training, users convenience are considered following, as a guideline, the development of input devices to permit higher speeds. The implications of parallel inputs (chord playing keyboards) and the consequent loss of flexibility are considered. Other non-keyboard systems are dealt with and some speculation as to usefulness of devices permitting perception and decoding of natural language is presented.
Author

N74-26634# Royal Aircraft Establishment, Farnborough (England).
FOUR CHANNEL MINIATURE TRANSMITTER FOR TRANSMITTING ELECTROENCEPHALOGRAMS FROM SMALL ANIMALS
W. Kraft and F. Voegeli Apr. 1974 13 p refs Transl. into

ENGLISH from AGEN-Mitt., v. 15, 1973 p 19-24
(RAE-Lib-Trans-1754; BR41243) Avail: NTIS HC $4.00

A description is given of the development of a 4-channel EEG transmitter, which is suited for long term experiments with rats or other small animals, because of its small dimensions and its low power consumption. The employment of a simple pulse interval modulation and the introduction of novel microwatt circuits made it possible to produce this transmitter. Author

N74-26635# Honeywell, Inc., Lexington, Mass.
A REMOTE OCULOMETER PERMITTING HEAD MOVEMENT Final Report, 1972 - 1973
John Merchant and Richard Morrisette Wright-Patterson AFB, Ohio AMRL Nov. 1973 39 p
(Contract F33615-72-C-1038; AF Proj. 7184)
(AD-776075; AMRL-TR-73-69) Avail: NTIS CSCL 06/2

The Cubic Foot Remote Oculometer is a new instrument for the remote measurement of eye direction and pupil diameter. The electro-optical sensor unit is located several feet from the subject, who is free to move the eye being sensed throughout 1 cubic foot of space. The video processing is performed in real time by a standard minicomputer. The oculometer processor (minicomputer) provides automatic calibration and linearization to each subject, and can supply the output eye direction information in the form of either fixation point coordinates on any specified fixation plane, azimuth and elevation, or direction cosines. The Oculometer measures line of sight to an accuracy of 1 degree for eye rotation angles, relative to the sensor unit, of from zero to +30 degrees elevation and from -30 to +30 degrees azimuth. Author (GRA)

N74-26636# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AN EVALUATION OF THE HONEYWELL 7A HELMET-MOUNTED DISPLAY IN COMPARISON WITH A PANEL DISPLAY; TARGET DETECTION PERFORMANCE Final Report
Harry L. Task and John P. Hornseth Jan. 1974 15 p
(AF Proj. 7184)
(AD-775993; AMRL-TR-74-3) Avail: NTIS CSCL 05/8

Target detection performance of two groups of eight subjects was compared. Subjects of one group wore the Honeywell Model 7A helmet-mounted display (HMD). A Hewlett-Packard Model panel display was used to present the imagery to the subjects of the other group. A 16mm movie projector and a TV camera were used to present the twenty-two target runs to terrain board imagery simulating inflight target search and detection. Performance scores obtained were average slant range to detection and number of correction identifications. Although performance (slant range and hits) with the panel display was slightly better than performance with the HMD, the difference in performance was not statistically significant. Implications for HMD design and evaluation are discussed. Author (GRA)

N74-26637# Perceptronics, Inc., Encino, Calif.
EXPERIMENTAL STUDY OF MAN/MACHINE INTERACTION IN ADAPTIVE COMPUTER AIDED CONTROL
Gershon Weltman, Randall Steeb, Amos Freedy, Michael Smith, and Richard Weisbrod Nov. 1973 60 p refs
(Contract N00014-72-C-0093; NR Proj. 196-118)
(AD-775879; TR-73-10) Avail: NTIS CSCL 05/5

The report presents the background and results of an experimental study focusing on human factors aspects of adpative computer aiding. Included are (1) a rationale for shared decision and control, (2) a description of the adaptive aiding computer program and task simulation developed for the experimental study, (3) the experimental design, procedure, and measurement techniques along with a discussion of the results, and (4) the development and testing of a program providing on-line estimation of operator utilities for his own and machine control. GRA

N74-26638# School of Aerospace Medicine, Brooks AFB, Tex.
AVIATOR'S BREATHING OXYGEN CONTAMINANT DETECTOR Interim Report, Oct. 1972 - Oct. 1973
Kenneth G. Ikels, Walter L. Crow, and Herman J. Kilian Feb. 1974 14 p refs
(AF Proj. 7164)
(AD-775727; SAM-TR-74-2) Avail: NTIS CSCL 06/11

The routine and special analysis of liquid aviator's breathing oxygen (ABO) is a problem faced by all Air Force operational flying bases. A portable infrared system has been developed that can rapidly determine the quality of ABO at the base level in aircraft, service cart, or bulk supply. The analyzer system was specifically designed to analyze ABO at the point of delivery to the pilot. The excellent performance of the analyzer system during laboratory and field tests, including investigation of a physiologic incident and a survey of contaminants in aircraft oxygen systems, has prompted further evaluation. An extensive program of development, test, and evaluation has been initiated at four Air Force flying bases and is now providing analysis of oxygen quality from several different aircraft. (Modified author abstract) GRA

N74-26639# Kentucky Univ., Lexington. Dept. of Physiology and Biophysics.
HUMAN LIMITATIONS IN OPERATION OF AEROSPACE SYSTEMS: CIRCULATORY REGULATION DURING COMBINED FLIGHT STRESSES Final Report, 1969 - 1973
Ernest P. McCutcheon and Charles F. Knapp 31 Aug. 1973 259 p refs
(Contract F44620-69-C-0127; AF Proj. 9777; AF Proj. 6813)
(AD-777218; AFOSR-73-2321TR) Avail: NTIS CSCL 06/1

Of the various stresses imposed upon subjects performing critical tasks, time dependent accelerations (vibration) can produce some of the greatest discomfort and decrements in performance. The effects of this stress on the cardiovascular system are being investigated in the laboratory. Instrumented animals are used to evaluate the cardiovascular changes produced by whole body, sinusoidal vibration. Experiments are designed to evaluate the role of five major mechanisms which current evidence indicates are the main factors producing these changes. Cardiovascular, hematological, and mechanical variables are used to evaluate the overall stress level. GRA

N74-26640# California Univ., Los Angeles. School of Engineering and Applied Science.
BIOCYBERNETIC CONTROL IN MAN-MACHINE INTERACTION Technical Report, period ending 31 Mar. 1974
Jacques J. Vidal Apr. 1974 102 p refs
(Contract DAHC15-73-C-0303; ARPA Order 2434)
(AD-777720; UCLA-ENG-7430; TR-1) Avail: NTIS CSCL 06/4

The research program aims at incorporating EEG evoked responses in man-machine communication. Present work is toward developing a new model for the phenomena of evoked responses in the EEG based on sequential events of short duration in the bio-electric potentials. Author (GRA)

N74-26532 Joint Publications Research Service, Arlington, Va.
EXPERIENCE IN CONSTRUCTING A SYSTEM FOR THE AUTOMATIC PROCESSING OF PHYSIOLOGIC INFORMATION
O. N. Apanasyuk, I. S. Shadrintsev, and A. A. Ignatov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 12-14 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 16-19 (For availability see N74-26527 16-04)

N74-26544 Joint Publications Research Service, Arlington, Va.
UTILIZATION OF THE WASTES IN A BIOENGINEERING COMPLEX IN A LIFE SUPPORT SYSTEM
T. S. Guryeva, N. A. Markova, and L. M. Krasotchenko *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 42-43 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 102-103 (For availability see N74-26527 16-04)

N74-26548 Joint Publications Research Service, Arlington, Va.
DIET DURING A YEARLONG MEDICAL ENGINEERING EXPERIMENT
A. N. Kozlova and G. N. Savelyeva *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 51-52 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 147-149 (For availability see N74-26527 16-04)

N74-26549 Joint Publications Research Service, Arlington, Va.
EFFECT OF 120-DAY HYPOKINESIA AND SOME PHARMACOLOGICALLY ACTIVE SUBSTANCES ON THE METABOLIC INDICES OF VITAMINS E, C AND B6
Ye. V. Kolchin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 53-55 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 152-154 (For availability see N74-26527 16-04)

N74-26550 Joint Publications Research Service, Arlington, Va.
CONSTRUCTING MEDICAL MONITORING EQUIPMENT FOR TRANSMITTING DATA THROUGH A COMMUNICATION CHANNEL WITH LIMITED CAPACITY
V. I. Kozharinov and N. V. Rozov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 56-60 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 156-160 (For availability see N74-26527 16-04)

N74-26553 Joint Publications Research Service, Arlington, Va.
EFFECT OF SKILL IN UNDERWATER ORIENTATION ON PERCEPTION OF THE GRAVITATIONAL VERTICAL
S. N. Makarov and B. B. Bokhov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 69 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 175-176 (For availability see N74-26527 16-04)

N74-26559 Joint Publications Research Service, Arlington, Va.
SOME PECULIARITIES OF COMMUNICATION PROCESSES IN SMALL GROUPS
T. V. Novikova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 81-82 Transl. into ENGLISH from the Publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 207-208 (For availability see N74-26527 16-04)

N74-26565 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF APPLYING THE AUTOGENIC TRAINING METHOD FOR COSMONAUTS
A. P. Ragulin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 96 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 234 (For availability see N74-26527 16-04)

N74-26569 Joint Publications Research Service, Arlington, Va.
RELIABILITY OF ARTERIAL PRESSURE MEASUREMENTS MADE BY PERSONS NOT HAVING A MEDICAL EDUCATION
V. F. Turchaninova and T. G. Chernysh *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 104-105 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 259-260 (For availability see N74-26527 16-04)

N74-26571 Joint Publications Research Service, Arlington, Va.
MODELING THE RELIABILITY PARAMETERS OF ORGANS USING ONE TYPE OF FINITE AUTOMATIC DEVICES
A. M. Tarko *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 108-109 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 262-263 (For availability see N74-26527 16-04)

N74-26572 Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF THE METHOD FOR REGISTERING THE INDICES OF PHYSIOLOGIC FUNCTIONS ON THE SOYUZ-9 SPACESHIP
V. A. Talavrinov, A. G. Zerenin, I. V. Sokolov, and V. F. Turchinova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 110-111 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 265-267 (For availability see N74-26527 16-04)

N74-26574 Joint Publications Research Service, Arlington, Va.
UNDERWATER TRAINING AS ONE OF THE FACTORS INCREASING VESTIBULAR-AUTONOMIC STABILITY
A. A. Chirkov, L. N. Kornilova, and S. N. Markov *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 115-117 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 286-287 (For availability see N74-26527 16-04)

N74-26587 Joint Publications Research Service, Arlington, Va.
CHANGE IN THE BALLISTOCARDIOGRAM OF HEALTHY AND SICK PERSONS WHEN BREATHING OXYGEN AT INCREASED INTRAPULMONARY PRESSURES
I. P. Poleshchuk *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 152-154 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 330-332 (For availability see N74-26527 16-04)

N74-26588 Joint Publications Research Service, Arlington, Va.
SANITARY-HYGENIC EVALUATION OF THE PROTECTIVE EFFECTIVENESS OF THE LEPESTOK MASK FOR FINELY DISPERSED AEROSOLS
L. N. Savelyev, A. M. Bulygina, M. V. Glushinskiy, and G. F. Kovygin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 155-156 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 333-334 (For availability see N74-26527 16-04)

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-26641# National Materials Advisory Board, Washington, D.C.
A SEMI-DELPHI EXERCISE ON SUBSTITUTE CATALYSTS FOR PLATINUM IN AUTOMOBILE EMISSION CONTROL DEVICES AND PETROLEUM REFINING Final Report
Mar. 1974 53 p
(Contract GS-00-DS-(P)-94008)
(NMAB-314) Avail: NTIS HC $5.75

A determination of the potential of base metal catalysts as substitutes for platinum and other related noble metal catalysts for automobile emission devices and petroleum refining is presented. Possible scenarios, after the introduction of the first generation of emission control devices containing platinum, are discussed along with suggested areas for research in base metal and platinum catalysts. Factors that could affect the requirements for automobile exhaust catalysts also were developed. Author

N74-26642# Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center.
ACTIVITY PATTERNS IN THE CATALYTIC REDUCTION OF SO2 ON SOME TRANSITION ELEMENTS IN ALUMINA
L. A. Haas, T. H. McCormick, and S. E. Khalafalla [1974] 16 p refs Prepared by Bur. of Mines, Twin Cities, Minn.
(APTIC-41914; BM-RI-7647) Avail: NTIS HC $4.00 CSCL 07B

The reduction of SO2 with CO was studied in an integral flow reactor at a nominal flow of 0.5 liter per minute. Reactant gas contained 3 percent SO2, 6 percent CO, and the balance He. Conversion of SO2 was determined for three different types of catalysts. The first consisted of 16 commercial catalysts used for various chemical syntheses. Only the commercial catalysts which contained transition metals in alumina removed more than 30 percent SO2 at temperatures below 510 C. Two other types of catalysts were prepared in the laboratory either by pelletizing equal amounts of powdered alumina and transition metal oxides or by impregnating commercial alumina tablets with transition metal ions. Regardless of preparation techniques, Cr and Fe in alumina were the two best catalysts. Observed results suggest that an intermediate (SCO) is formed by the interaction of surface

metal sulfides and carbonyls. Alumina then catalyzes the interaction of SCO with SO2 to form the end products (sulfur and carbon dioxide). Over 80 percent SO2 was removed at 460 C with 2 grams alumina impregnated with 2.5 percent iron. Author

N74-26643*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
TRANSMISSIVITY OF CARBON MONOXIDE Final Report
S. R. Drayson, R. Tallamraju, and L. W. Chaney Feb. 1973 24 p refs
(Contract NSR-23-005-470; ORA Proj. 010105)
(NASA-CR-138656; UMICH-010105-1-F) Avail: NTIS HC $4.25 CSCL 07D

The line strengths and self- and nitrogen-broadened half widths for selected lines of the 4.6 micron fundamental band of carbon monoxide were determined. The band strength determined at stp. is higher than previously reported measurements. The half widths agree well with other measurements and calculations. Author

N74-26644*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPOSITION SURVEYS OF TEST GAS PRODUCED BY A HYDROGEN-OXYGEN-AIR BURNER
James M. Eggers Jun. 1974 47 p refs
(NASA-TM-X-71964) Avail: NTIS HC $3.25 CSCL 07D

As a result of the need for a uniform hot gas test stream for fuel injector development for hydrogen fueled supersonic combustion ramjet engines, an experimental study of injector configuration effect on exit flow uniformity of a hydrogen fueled oxygen replenished, combustion burner was made. Measurements used to investigate the burner nozzle exit profiles were pitot and gas sample measurements. Gas composition and associated temperature profiles were reduced to an acceptable level by burner injector modifications. The effect of the injector modifications was to redistribute the hydrogen fuel, increase the air pressure drop, promote premixing of the oxygen and air, and establish a uniform flow pattern where the oxygen-air mixture comes into contact with the hydrogen fuel. The most sensitive phenomenon which affected the composition profiles was the uniformity of the air distribution supplied to the combustion chamber. Author

N74-26645# Royal Aircraft Establishment, Farnborough (England).
TWO-DIMENSIONAL CHROMATOGRAPHY OF A CORTICOSTEROID MIXTURE IN A THIN LAYER OF KSK SILICA GEL
V. I. Volkova, G. A. Gaziyev, and L. A. Popova Jul. 1973 8 p refs Transl. into ENGLISH from Vopr. Med. Khim. (Moscow), v. 16, Jan./Feb. 1970 p 101-103
(RAE-Lib-Trans-1705; BR36946) Avail: NTIS HC $4.00

A method of two-dimensional chromatography in a thin layer of KSK silica gel was used to effect the separation of a mixture of corticosteroids. The mixture was completed of cortisone, cortisol and their tetrahydro-derivatives, corticosterone, aldosterone, 11-dehydrocorticosterone, desoxycorticosterone, substance S and its tetrahydro-derivative. Author

N74-26646# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
SUDIES ON THE ANTIOXIDATIVE EFFECTIVENESS OF SELECTED PHENOLS AND AROMATIC AMINES IN n-HEXADECANE AT ELEVATED TEMPERATURES
Guenter Spengler, Rudolf Woerle, and Ingo Jung Aug. 1973 33 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-103) Avail: NTIS HC $4.75, DFVLR, Porz, West Ger. 14 DM

The inhibiting effectiveness of some phenol derivates and aromatic amines on autocatalytic oxidation of n-hexadecane at 145 deg was investigated. The linear relationship between inhibitor concentration and induction period that is valid within a limited concentration range is attributed to an inhibitor consumption which occurs at a constant rate. Based on an equivalent concentration on functional groups, aromatic amines show a higher effectiveness than phenol derivates, using the given test conditions. Author (ESRO)

N74-26647# Unilever Research, Vlaardingen (Netherlands).
CARBON-13 MAGNETIC RESONANCE ANALYSIS OF METHYL OCTADECENOATES
J. Bus and D. J. Frost [1973] 10 p refs Revised Submitted for publication
Avail: NTIS HC $4.00

Carbon-13 magnetic resonance spectra of cis and trans methyl octadecenoates with the double bond positions 8, 9, 10, 11, and 12 were measured. The chemical shift of the allylic carbon atoms is largely dependent on the stereochemistry of the double bond: delta approximately 27.3 ppm for the cis and delta approximately 32.6 for the trans configuration. The difference in chemical shift between the two ethylenic carbon absorptions increases significantly as the double bond approaches the ester group. Thus, the position as well as the configuration of the double bond in 8 to 12-methyl octadecenoates can readily be established by carbon-13 magnetic resonance. Author (ESRO)

N74-26648# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
DIFFUSION OF HYDRODGEN AND DEUTERIUM IN RUTILE Ph.D. Thesis
Su-Hyon Paek 4 May 1974 73 p refs
(AD-776584) Avail: NTIS CSCL 07/4

The effect of internal electric fields, due to changing concentration of a diffusing ion, on the measured diffusion rate is considered. It is shown that the effect of such fields can completely dominate the diffusion process in a material like TiO2, leading to dramatic departures from Fick's law. An isotope exchange technique is described, which almost completely suppresses the internal fields and hence permits accurate determination of the real diffusion parameters. This technique has been applied to the diffusion of H and D in TiO2 and accurate values of all diffusion parameters for diffusion parallel and perpendicular to the c-axis have been obtained. The diffusion appears to be a simple thermally activated process over a wide range of temperatures, with activation energies of 0.59 and 1.28 eV, for diffusion parallel and perpendicular to the c-axis, respectively. Large departures from Fick's law behavior for single diffusion have also been demonstrated. Author (GRA)

N74-26649# AeroChem Research Labs., Inc., Princeton, N.J.
KINETICS OF Al ATOM OXIDATION Final Report, 1 May 1972 - 31 Aug. 1973
Arthur Fontijn, William Felder, and James J. Houghton Sep. 1973 36 p refs
(Contract DNA001-72-C-0206; ARPA Order 1433; DNA Proj. NWET-M99QAXI)
(AD-776673; AeroChem-TP-299; DNA-3242F) Avail: NTIS CSCL 07/4

The kinetics of the Al/O2 reaction system has been studied with the AeroChem high-temperature fast-flow reactor (an adaptation of the steady-state flow reactor suitable for measurements at temperatures up to 2000K). The rate coefficient for the homogeneous gas-phase reaction Al - O2 to AlO - O has been determined. Evidence for a zero-order and a first order wall Al-oxidation process were also obtained. Comparison is made to other metal atom oxidations. (Modified author abstract) GRA

N74-26650# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ANALYSIS OF SILICIDE FORMATION
Robert W. Bower, Wei-Kan Chu, Herbert Krautle, James W. Mayer, and Marc A. Nicolet 15 Oct. 1973 74 p refs Prepared in cooperation with IBM, San Jose, California
(Contract F19628-73-C-0174; AF Proj. 5638)
(AD-776029; AFCRL-TR-73-0709; SR-2) Avail: NTIS CSCL 07/4

Contact formation in semiconductor integrated circuit technology involves deposition of one or more layers of metal 1000 to 10,000A thick on the surface of selected areas of Si. To form low resistance contacts, it is usually necessary to heat to temperatures between 400 and 600C. At these temperatures Si reacts with the metal film. The purpose of this study was to investigate these reactions. A review of silicide formation is

included as an appendix. A survey of silicide formation for metal films deposited on Si indicates that the typical silicide that is formed is the phase that is most rich in Si. This is the end point one expects from thermodynamic equilibrium considerations. One recent observation is that metal rich silicides are formed when the metal layer is deposited on SiO2 rather than Si. GRA

N74-26651# Utah Univ., Salt Lake City. Dept. of Chemistry.
BRILLOUIN AND RAYLEIGH SCATTERING IN POLYBUTADIENE Technical Report, 1 Apr. 1973 - 31 Mar. 1974
Y. Y. Huang and C. H. Wang 22 Mar. 1973 29 p refs
(Contract N00014-67-A-0325-0007; NR Proj. 051-562)
(AD-776665; TR-5) Avail: NTIS CSCL 07/4

The molecular light scattering of polybutadiene from 110 to 350K was carried out. The study includes the measurements of Brillouin shift, Brillouin linewidth and Rayleigh depolarization ratios as a function of temperature. It has been found that the hypersonic frequency displays a discontinuity at the glass temperature Tg. The hypersonic attentuation coefficient over one wavelength has also been determined as a function of temperature. No quantitative theory has been found to be able to describe the sound attenuation above Tg. The Krishnan effect was also observed below 250K. This is the first experiment which observes the evolution of the Krishnan effect. It has been pointed out that the frozen-in density fluctuation mechanism fails to explain the effect. The frozen-in fluctuations of the dielectric anisotropy is suggested to be a possible mechanism for the Krishnan effect. (Modified author abstract) GRA

N74-26652# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
INFRARED SPECTRAL REFLECTANCE OF PLUME SPECIES ON COOLED LOW SCATTER MIRRORS Final Technical Report, Sep. 1971 - Jun. 1973
Frederick Arnold, Richard B. Sanderson, and Arlan W. Mantz Sep. 1973 240 p
(AF Proj. 7660; AF Proj. 5730)
(AD-777285; AFRPL-TR-73-52) Avail: NTIS CSCL 07/4

Infrared spectral reflectance measurements were made of N2, O2, CO2, H2O, NH3 and N2/NH3 cryodeposits on low scatter nickel-coated mirrors. Deposits were produced with a molecular beam to simulate contamination of sensor optics at high altitudes. Infrared optical constants, visible refractive indices and average deposit densities were explicitly obtained for all species. In general, the deposits could be characterized as homogeneous specular films of uniform thickness and with optical constants only occasionally dependent on deposition conditions. Using this physical model and these optical constants, excellent agreement was obtained between theoretical reflectance calculations and the experimental spectra for deposits thinner than 5 micrometers. In some cases, films fragmented or crystallized into diffusely reflecting deposits. Conditions under which this phenomenon occurred are also considered. (Modified author abstract) GRA

N74-26653# Battelle Columbus Labs., Ohio.
QUANTUM THEORY OF GAS-SURFACE INTERACTIONS Final Report, 30 Jun. 1972 - 30 Jun. 1973
Edmund J. Drauglis and Jerome I. Kaplan Aug. 1973 15 p refs
(Grant AF-AFOSR-2354-72; AF Proj. 9783)
(AD-777304; AFOSR-74-0465TR) Avail: NTIS CSCL 07/4

The purpose of this research program is to develop a better understanding of how gases at thermal energies interact with metallic surfaces. Such an understanding should not only help to explain a large body of data obtained in experimental investigations on the fundamental properties of surfaces but may also provide a useful computational tool for practical applications such as the computations of drag coefficients and heat exchange parameters of high-altitude, high-speed aircraft. A formalism was developed to permit calculations of energy and momentum exchange probabilities for gases impinging on bare metallic surfaces. A mixed classical and quantum-mechanical approach was used and the basic technique involved the application of two-step time-dependent perturbation theory. The calculation resulted in an expression for the probability of energy transfer which included all multiphonon events. GRA

N74-26582 Joint Publications Research Service, Arlington, Va.
DETERMINING ETHYL ALCOHOL IN WATER CONDENSATES BY THE GAS CHROMATOGRAPHY METHOD
Yu. A. Novikov and A. V. Vikhlyantsev *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 141-142 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 319-320
(For availability see N74-26527 16-04)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-26654* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DIFFERENTIAL PHASE SHIFT KEYED COMMUNICATION SYSTEM Patent
Philip M. Hopkins (Lockheed Electron. Co., Houston, Tex.) and Wally M. Wallingford, inventors (to NASA) (Lockheed Electron. Co., Houston, Tex.) Issued 11 Jun. 1974 10 p Filed 12 Oct. 1972 Sponsored by NASA
(NASA-Case-MSC-14065-1; US-Patent-3,816,657;
US-Patent-Appl-SN-297128; US-Patent-Class-178-67;
US-Patent-Class-325-30) Avail: US Patent Office CSCL 17B

A communication system using differential phase-shift-keying (DPSK) transmits and receives binary data without requiring timing or phase reference signals. The system encodes and modulates the data at the transmitter, and decodes and demodulates the data at the receiver, without ambiguity as to the data content. Official Gazette of the U.S. Patent Office

N74-26655 Stanford Univ., Calif.
AMPLITUDE VARIATIONS OF WHISTLER-MODE SIGNALS CAUSED BY THEIR INTERACTION WITH ENERGETIC ELECTRONS OF THE MAGNETOSPHERE Ph.D. Thesis
Louis Christian Bernard 1974 163 p
Avail: Univ. Microfilms Order No. 74-13601

Whistler mode waves that propagate through the magnetosphere exchange energy with energetic electrons by wave-particle interaction mechanisms. Using linear theory, a detailed investigation is presented of the resulting amplitude variations of the wave as it propagates. Arbitrary wave frequency and direction of propagation are considered. A general class of electron distributions that are nonseparable in particle energy and pitch angle is proposed. Comparison with data is obtained by computing the total amplitude variation between two locations along the wave ray path. It is found that the proposed distribution model is consistent with available whistler and particle observations. Dissert. Abstr.

N74-26656 Stanford Univ., Calif.
RADIO-WAVE SCATTERING FROM ROUGH SURFACES AND THE ESTIMATION OF SURFACE SHAPE Ph.D. Thesis
Michael Noel Parker 1974 113 p
Avail: Univ. Microfilms Order No. 74-13673

Techniques are reported for estimating surface shapes from measurements of radio wave scattering properties and results are applied to the interpretation of radar astronomy data. Emphasis is focused on the determination of lunar and planetary surfaces, and scattering characteristics observed from spacecraft or interplanetary radar are retained when making modeling assumptions. A physical optics model is developed to estimate surface-shape parameters. Scattering equations are derived in the form of Fourier transformations and one-to-one mapping. These, combined with measurements of backscattered electromagnetic energy, are used to estimate the height power spectrum of such highly conductive surfaces as oceans. A specular point model is applied to extract lunar slope frequency distributions from bistatic radar data. Lunar slope estimates obtained from 13-cm bistatic radar data are found to be in good agreement with photographic slope estimates of 50 m slope length. Dissert. Abstr.

N74-26657 Stanford Univ., Calif.
PULSE PROPAGATION IN AN INHOMOGENEOUS MEDIUM Ph.D. Thesis
Donald Brooks Longcope, Jr. 1974 152 p
Avail: Univ. Microfilms Order No. 74-13657

A pulse propagating through an inhomogeneous medium is considered whose properties change continuously with position. Asymptotic solutions are developed for a one dimensional, dilatational pulse propagating through an elastic half space with variable wave speed. Solutions are obtained in a similar manner for a wide class of one dimensional pulse propagation problems described by linear, second order, partial differential equations with spatially variable coefficients. A closed form asymptotic solution for the stress is accomplished by iterating on the W.K.B. approximation to time-harmonic waves of short wave length or high frequency, and then performing an integral superposition to obtain the transient. An improved, mixed asymptotic solution for both the stress and velocity is developed by using the Duhamel formula and an integration by parts. Dissert. Abstr.

N74-26658 Pennsylvania Univ., Philadelphia.
TRANSIENT ELECTROMAGNETIC PROPAGATION IN A UNIFORMLY MOVING DISPERSIVE MEDIUM Ph.D. Thesis
Ronald Alan Pearlman 1973 67 p
Avail: Univ. Microfilms Order No. 74-14124

The problem of a sinusoidal electromagnetic pulse in a uniformly moving, isotropic plasma is examined. The Fourier components of the pulse are transformed into the moving frame through the Lorentz transformation, and the dispersion relation in the moving frame is derived, using the inverse Doppler equation. The total pulse is obtained by integrating the Fourier components in the complex frequency plane, using a steepest descent approximation. The observed pulse is shown to have a long precursor, followed by a rapid rise toward the steady state pulse level, when the plasma is moving slower than the group velocity of the pulse. Only the precursor or transient is observed when the plasma is moving faster. Dissert. Abstr.

N74-26659 Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
ON THE TIME DEPENDENT PROPERTIES OF RADAR ECHOES FROM AIRCRAFT
K. VonSchlachta May 1973 24 p Presented at the meeting of NATO SG 13, San Diego, Calif., 16-18 May 1973
(Rept-202) Copyright. Avail: Issuing Activity

The time behavior of coherent aircraft signals is discussed. Measurement equipment and short time and long time behavior of the signals is considered. Doppler phase shifts were calculated from geometrical relationships of the flight path. Author (ESRO)

N74-26660# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
NBS FREQUENCY AND TIME BROADCAST SERVICES. RADIO STATIONS WWV, WWVH, WWVB, AND WWVL Final Report
Peter P. Viezbicke, ed. Mar. 1974 19 p refs
(NBS Proj. 2730121)
(NBS-SP-236) Avail: SOD HC $0.60 as C13.11:236

Detailed descriptions are given of the technical services provided by the National Bureau of Standards radio stations WWV, WWVH, WWVB and WWVL. These services are: (1) Standard radio frequencies; (2) Standard audio frequencies; (3) Standard musical pitch; (4) Standard time intervals; (5) time signals; (6) UT1 corrections; and (7) official announcements. In order to provide users with the best possible services, occassional changes in broadcasting schedules are required. This publication shows the schedules in effect on January 1, 1974. Annual revisions will be made. Current data relating to standard frequencies and time signals are available monthly in the Time and Frequency Services Bulletin. Advance notices of changes occuring between revisions will be sent to users of NBS broadcast services who request such notice on the basis of need. Author

N74-26661# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SAMPLING THEOREM WITH SMALL TRUNCATION ERROR
J. Hagenauer Oct. 1972 10 p refs Transl. into ENGLISH from Arch. Elek. Uebertrag. (West Germany), v. 26, no. 4, 1972 p 181-184
(NTC-74-11873) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The sampling theorem for a signal band limited to omega sub g can be extended by an additional function if the separation of the sampled values is less than pi/omega sub g. The sampling error due to the use of a finite number of samples is thereby reduced substantially. An upper bound is given for the truncation error. Application of results yields a numerical interpolation and a pulse transmission filter design. Author

N74-26662# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANGULAR ACCURACY OF AMPLITUDE DIRECTION FINDING BY MEANS OF PHASED ARRAYS
N. P. Kransnenko and G. N. Glazov Jul. 1973 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 16, no. 2, 1973 p 23-27
(NTC-74-11938; Rept-73-156) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Error in the amplitude method of single pulse direction finding arrays are investigated. Noise and spatial time fluctuations in the signal field for a given correlation of the signal field are given for an approximation of small apertures and selection time. Author

N74-26663*# Ohio State Univ., Columbus. ElectroScience Lab.
A STUDY OF KC-135 AIRCRAFT ANTENNA PATTERNS
W. D. Burnside, R. J. Marhefka, and C. L. Yu Mar. 1974 22 p refs
(Grant NGR-36-008-144)
(NASA-CR-138585; ESL-3001-9) Avail: NTIS HC $4.25 CSCL 17B

Numerical solutions for the radiation patterns of aircraft antennas are evaluated. Designing and locating antennas in order to achieve the desired performance is discussed. The high frequency solutions presented in this report are based on fuselage antennas mounted on a general-type aircraft but applied specifically to the KC-135 aircraft. The roll and elevation plane patterns are computed for a monopole, axial slot, and circumferential slot mounted both over and forward of the wings. In each case the calculated patterns compare very favorably with the measured patterns. The precision pattern measurements were taken on a 1/25 scale model of the KC-135 aircraft at NASA (Langley, Virginia) with special emphasis on reducing the mount and background effects. Author

N74-26664*# City Coll. of the City of New York. Communications Systems Lab.
OPTIMAL SPACE COMMUNICATIONS TECHNIQUES Final Report, 22 Jan. 1973 - 21 Jan. 1974
Donald L. Schilling 21 Jan. 1974 60 p refs
(Grant NGR-33-013-077)
(NASA-CR-138606) Avail: NTIS HC $6.00 CSCL 17B

Digital multiplication of two waveforms using delta modulation (DM) is discussed. It is shown that while conventional multiplication of two N bit words requires N2 complexity, multiplication using DM requires complexity which increases linearly with N. Bounds on the signal-to-quantization noise ratio (SNR) resulting from this multiplication are determined and compared with the SNR obtained using standard multiplication techniques. The phase locked loop (PLL) system, consisting of a phase detector, voltage controlled oscillator, and a linear loop filter, is discussed in terms of its design and system advantages. Areas requiring further research are identified. A.A.D.

N74-26665*# Maryland Univ., College Park. Dept. of Electrical Engineering.
STUDY OF OPTIMUM METHODS OF OPTICAL COMMUNICATION Final Technical Report
Robert O. Harger 8 May 1974 20 p refs
(Grant NGR-21-002-237)
(NASA-CR-138672) Avail: NTIS HC $4.00 CSCL 17B

Abstracts are reported relating to the techniques used in the research concerning optical transmission of information. Communication through the turbulent atmosphere, quantum mechanics, and quantum communication theory are discussed along with the results. M.C.F.

N74-26666*# Ohio State Univ., Columbus. ElectroScience Lab.
COMPUTER ANALYSIS OF AIRCRAFT AND SHUTTLE ANTENNAS Semiannual Status Report, 15 Nov. 1973 - 15 May 1974
W. D. Burnside and J. H. Richmond Jun. 1974 12 p ref
(Grant NGL-36-008-138)
(NASA-CR-138605; ESL-2902-16) Avail: NTIS HC$4.00 CSCL 17B

Progress on predicting the patterns of high-frequency antennas on aircraft and shuttles is reported. Patterns are presented for an axial slot antenna on a circular cylinder partially coated with a dielectric layer. Results are shown for Omega signal disturbance by a conducting vertical pole. Author

N74-26667# Joint Publications Research Service, Arlington, Va.
REMOTE MEASUREMENTS OF WIRE BROADCASTING LINES
V. A. Nyurenberg 28 May 1974 46 p Transl. into ENGLISH of the publ. "Distantsionnyye Izmereniya Traktov Provodnogo Veshchaniya' Moscow, 1954 35 p
(JPRS-62096) Avail: NTIS HC $5.50

The work of the Moscow City Radio Rebroadcasting Network is discussed with respect to measurement of quality of wire broadcasting lines in Moscow. Author

N74-26668*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TASK 60 TEST REPORT, EVALUATION OF IRIG-A 21 CHANNEL CONSTANT BANDWITH FM MULTIPLEXER FOR SHUTTLE DEVELOPMENT FLIGHT INSTRUMENTATION
C. M. Haddick May 1974 151 p
(Contract NAS9-12200)
(NASA-CR-134304; LEC-3558; JSC-09017) Avail: NTIS HC $10.75 CSCL 17B

A frequency modulated (FM) multiplexer, consisting of 21 IRIG-A constant bandwidth (CBW) voltage-controlled oscillators (VCO's) was tested to determine its suitability for use in multiplexing 21 data signals which have frequency ranges of dc to 2 kHz. Tests were preformed with the composite signal, consisting of the mixed outputs of the 21 VCO's connected directly to a set of subcarrier discriminators, with the signal recorded on magnetic tape and played back through the discriminators and with the signal transmitted by a frequency-modulated FM S-band radio frequency RF transmitter to a FM receiver and through the subcarrier discriminators. Tape speed flutter was induced to determine the reduction in flutter noise which can be obtained by the tape speed compensation equipment. The RF transmission test included transmitting the composite signal at a nominal RF received signal of -73 dbm and at RF levels of -83 and -86 dbm. F.O.S.

N74-26669# Joint Publications Research Service, Arlington, Va.
VUS-12-2 AUXILIARY AMPLIFYING STATIONS
N. A. Grishko and A. V. Sheremetev 22 May 1974 68 p Transl. into ENGLISH of the pamphlet "Vspomogatelnyye Usilitelnyye Stantsii VUS-12-2" Moscow, USSR Ministry of Communications, Engineering Administration 64 p
(JPRS-62067) Avail: NTIS HC $6.50

The qualitative indices of communication by a Soviet 12-channel HF telephony system depend to a considerable degree upon the weather conditions. In order to provide a constancy of channel characteristics in unfavorable meteorological conditions, a modernization program for the auxiliary amplifying stations was carried out. The improved apparatus is considered in detail including the basic technical parameters, the design features, and the principles of operation. Author

N74-26670*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SOLAR RADIO OBSERVATIONS IN SUPPORT OF SKYLAB A Final Report, 1 Oct. 1972 - 31 Mar. 1974
Bruce L. Gotwols May 1974 36 p refs
(Grant NGR-21-001-024)
(NASA-CR-138669; S1P-198-74) Avail: NTIS HC $5.00 CSCL 03B

The solar radio spectra were recorded in real time, both on film and magnetic tape, during the period from November 1972 to February 1974. A catalogue of the observations is given for the frequency range 565-1000 MHz and includes descriptions of the bursts, intensity scales, and pertinent remarks. Some theoretical considerations resulting from the research are given. Equipment modified for the experiment is described and the text of the final report which summarizes the research on type IV solar radio bursts is included. A.A.D.

N74-26671# RAND Corp., Santa Monica, Calif.
ALMOST PAINLESS QUANTUM ELECTRODYNAMICS
B. W. Augenstein Jan. 1974 15 p refs
(P-5148) Avail: NTIS HC $4.00

The partial differential equations are considered that govern a centrally important segment of relativistic quantum electrodynamics -- namely, radiative corrections introduced by the quantization of the electromagnetic radiation field. The most convenient way of describing these radiative corrections, in the conventional approaches, probably lies in the perturbation theory expansion of the S-matrix (scattering matrix) for an unbound electron. Transition amplitudes between two plane wave solutions of the field free positive energy Dirac equation are used to describe how the electron interacts with its own virtual radiation field. Author

N74-26672*# General Electric Co., Syracuse, N.Y. Electronics Lab.
LOW COST GROUND RECEIVING SYSTEMS FOR TELEVISION SIGNALS FROM HIGH-POWERED COMMUNICATIONS SATELLITES. VOLUME 2: PARTS LIST AND ENGINEERING DRAWINGS Final Report
J. P. Hesler, Y. C. Huang, and J. J. Zampini [1974] 94 p Sponsored by NASA
(NASA-CR-120933) Avail: NTIS HC $7.75 CSCL 17B

Parts lists for the 2.25 GHz indoor- and antenna-unit assemblies are followed by drawings that constitute the drafting package for three converter types and the tunnel diode amplifier. G.G.

N74-26673# Royal Aircraft Establishment, Farnborough (England).
TAPE TRANSPORT PROBLEMS IN MAGNETIC TAPE RECORDERS
Ladyslaw Gronau Jan. 1974 42 p refs Transl. into ENGLISH from Prace Inst. Elektrotech. (Warsaw), v. 20, no. 71, 1972 p 1-38
(RAE-Lib-Trans-1710; BR39609) Avail: NTIS HC $5.25

Various types of magnetic tape recorders are classified in four groups. Their applications are briefly discussed and a table is given of the average values of their principal parameters. The requirements of tape drive mechanisms are considered. Problems of tape motion are discussed in relation to the associated mechanical, pneumatic or friction method of forcing tape motion, either continuously or only for the duration of tape movement. Tape path problems are considered in a straight through system as well as in loop and buffer systems and the location of the drive and spool elements. The description of a constant tension solution is included. The uses of a velocity and position type servo system are considered, and the need for each type of servo system is explained. The use of a recorded reference signal for the elimination of timing errors is discussed. Author

N74-26674# Royal Aircraft Establishment, Farnborough (England).
AN EXPERIMENTAL STUDY OF THE TRANSMISSION OF INFORMATION BY MEANS OF A KEYBOARD AND DISPLAY SCREEN
J. C. Sperandio Jan. 1974 24 p refs Transl. into ENGLISH from Bull. du CERP (France), v. 17, no. 3, 1968 p 191-203
(RAE-Lib-Trans-1729; BR39607) Avail: NTIS HC $4.25

Experiments, concerned with the real-time relationship between an operator and a computer within the framework of air traffic control operations, are described. The operator must check the accuracy of the coded digital data store in the computer memory and displayed on a cathode ray tube and must reply to the computer by means of a keyboard, thereby correcting any

wrong information. The first phase examines and discusses training in the operation of the keyboard. The second phase distinguished and analyzes the workload relative to data control and that relative to keyboard operation, while varying the usable operating methods. Author

N74-26675# Royal Aircraft Establishment, Farnborough (England).
INTELLIGIBILITY OF SPEECH TRANSMISSION, INFLUENCING FACTORS, SYSTEMS AND ENVIRONMENTS
Bo Egerborg Sep. 1973 139 p refs Transl. into ENGLISH of "Uppfattbarhet vid Taloeverfoering, Inverkande fak torer, System och Miljoe", Res. Inst. of Natl. Defence, Sweden, report FOA-3-A-3742-57, 1970
(RAE-Lib-Trans-1715; BR37647; FOA-3-A-3742-57) Avail: NTIS HC $10.00

The general characteristics of speech and hearing and of voice communication systems are dealt with, followed by some methods for determining the intelligibility of speech. The effects on the intelligibility of speech owing to noise and other interference, filtering, non-linear distortion, etc. are discussed in detail. A special section is devoted to the electro-acoustic components normally involved in equipment for speech transmission. A noise catalogue containing measured spectra from some typical environments is given. A large number of bibliographical references are included. Author

N74-26676# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
HIGH FREQUENCY RADIATION PATTERN PREDICTION FOR SATELLITE ANTENNAS Final Report
H. Bach Dec. 1973 114 p refs
(Contract ESTEC-1821/72-HP)
(R-121; ESRO-CR(P)-406) Avail: NTIS CC $8.75

Geometrical diffraction theory is used simulating satellite antenna radiation patterns. For individual titles, see N74-26677 through N74-26679.

N74-26677 Technical Univ. of Denmark, Lyngby.
THE POLYHEDRAL SATELLITE MODEL
H. Bach *In its* High Freq. Radiation Pattern Prediction for Satellite Antennas Dec. 1973 p 4 - 50 refs (For availability see N74-26676 16-07)

Computerized ray tracing for a dipole antenna mounted on a convex polyhedron as simple satellite model was performed. The diffraction coefficients for a straight wedge were determined and the diffraction by a rectangular cylinder was considered. Numerical and experimental results were compared. author (ESRO)

N74-26678 Technical Univ. of Denmark, Lyngby.
THE CIRCULAR CYLINDRICAL SATELLITE MODEL
Knud Pontoppidan *In* Its High Freq. Radiation Pattern Prediction for Satellite Antennas Dec. 1973 p 51 - 74 refs (For availability see N74-26676 16-07)

The geometrical theory of diffraction for calculating antenna radiation patterns was applied on a circular cylindrical satellite model. Results show that with singly diffracted rays the radiation calculated are in good agreement with measured results. The influence of long booms can be neglected and a quarter wave monopole on a surface can be treated without further complications as a point source elevated a quarter of a wavelength above the surface. A circular wedge gives rise to caustic directions in the far field not only when the source is placed on the axis but also for other positions of the source. Author (ESRO)

N74-26679 Technical Univ. of Denmark, Lyngby.
DIFFRACTION COEFFICIENTS FOR SENSOR BOOMS
Laszlo Solymar *In its* High Freq. Radiation Pattern Prediction for Satellite Antennas Dec. 1973 p 75 - 109 refs (For availability see N74-26676 16-07)

Diffraction coefficients were derived for thin wires. They may be used for calculating the mutual impedance between half-wave dipoles in echelons. With the exception of the collinear case, the approximation is correct asymptotically, that is, when

N74-26680# Laboratoire Central de Telecommunications, Paris (France). Radar Div.
HIGH FREQUENCY RADIATION PATTERN PREDICTION FOR SATELLITE ANTENNAS Final Report, Jul. 1973
F. Molinet and L. Saltiel 14 Sep. 1973 245 p refs
(Contract ESTEC-1820/72-HP)
(PL-603-314; ESRO-CR(P)-405) Avail: NTIS HC $15.25

The geometrical theory of diffraction was applied to high frequency radiation pattern prediction for satellite antennas. General equations for rays diffracted by any structure were drawn up and divergence factors for different kinds of rays were calculated. The total field, in the case of a cylinder without accessories and illuminated by an eccentric electrical dipole, was calculated. Author (ESRO)

N74-26681# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
EFFECT OF CATHODIC PROTECTION OF GAS PIPELINES ON SUBMARINE CABLES [BEINVLOEDING VAN ZEEKABELS VOOR DE KATHODISCHE BESCHERMING VAN GASPIJPLEIDINGEN]
R. Leur Mar. 1974 20 p refs In DUTCH
(ChL-309) Avail: NTIS HC $4.00

The consequences of a submarine cable and a gas pipeline touching each other in the North Sea bed were investigated. Cathodically protected gas pipes and submarine cables cross each other in the sea bottom at a distance of about 2 to 3 m under about 80 deg. By sand displacements, it is possible that pipe and cable touch each other without making metallic contact, and it is possible that a Zn anode on the pipe can cause a carrier transport in cable insulation. ESRO

N74-26682# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
DESCRIPTION OF 90/96 CHANNEL PCM SYSTEMS EQUIPMENT [BESCHRIJVING 90/96-KANALEN PCM-SYSTEEMAPPARATUUR]
A. Schouman Oct. 1972 56 p In DUTCH
(TL-290) Avail: NTIS HC $6.00

The PCM systems equipment for telephone lines provides the means of adapting terminal to line equipment and vice versa by multiplexing and demultiplexing. The features of a 90 channel PCM transmission system are detailed to the level of printed circuits. Author (ESRO)

N74-26683# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
TIME SYSTEMS AND TIME INDICATION [TIJDSYSTEMEN EN TIJDAANWIJZING]
C. J. Sanders Feb. 1973 26 p In DUTCH
(AD-294) Avail: NTIS HC $4.50

Various time systems are discussed, notably real and average solar time, sideral time, universal time, ephemeris time, and atomic time. The organization of the time network in the Netherlands is considered. Practical time measurement, particularly photographic zenith tubes, derivation of universal time from astronomical time and radio time signals, is detailed. Author (ESRO)

N74-26684# Ohio State Univ., Columbus. Dept. of Speech Communication.
ANALYSIS OF INTONATIONAL SIGNALS BY COMPUTER SIMULATION OF PITCH-PERCEPTION BEHAVIOR IN HUMAN LISTENERS
Yukio Takefuta Feb. 1974 27 p refs
(Contract N00014-67-A-0232-0003; SURF Proj. 2928; NR Proj. 194-004)
(AD-776647; TR-15) Avail: NTIS CSCL 05/7

Computer methods for extracting physical parameters, comparing the relative efficiency of the parameters as an intonational signal, processing the extracted data, and extracting and identifying pitch patterns, are described. Fundamental pattern features and cardinal pitch patterns are defined and proposed as constituents of intonation patterns. (Modified author abstract) GRA

N74-26685# Army Electronics Command, Fort Monmouth, N.J.

130 p ref
(DA Proj. 1S6-62703-A-175)
(AD-776912; ECOM-4201) Avail: NTIS CSCL 17/9

The presentation covers the analysis, computer solution and simulation, design, construction and performance evaluation of an experimental digital time converter with five compression ratios ranging from 3.16 to 316 in a geometric progression. With an analog to digital converter at the input and a digital to analog converter at the output, this time converter operates with data samples circulating in register rings. The updating of this rotating information occurs at selected slow rates while readout samples are taken at a constant fast rate. The original sequence of input samples is preserved in the compressed output when a correct relationship exists between updating and readout rates, generated in appropriate timing circuits. The compressed signal is presented in segments of approximately .5 second each. The performance evaluation shows that the chosen approach is valid, that an experimental model works as expected, and that subsequent radar systems studies can be made with this time converter. (Modified author abstract) GRA

N74-26686# Lincoln Lab., Mass. Inst. of Tech., Lexington.
APPLICATION OF ADAPT TO QUICK LOOK CLASSIFICATION OF COMPOSITE RADAR SIGNATURES Final Report on Task 1
Herbert E. Hunter Nov. 1973 193 p refs Prepared by ADAPT Service Corp., Reading, Mass.
(Contract F19628-73-C-0002)
(AD-776031; ESD-TR-74-15; ADAPT-73-3) Avail: NTIS CSCL 17/9

The ADAPT Computer Programs, (a series of empirical analysis programs based on the concept that pattern recognition and regression analysis should be preceded by a reduction in the dimensionality based on the Karhunen-Loeve expansion), were applied to composite radar signatures of two classes of targets to develop and study classification laws and mechanisms for separating the two classes. The results include definition of the significance of each of the components of the data vector to each algorithm developed. Both a two step and a number of single step algorithms were developed. The phase of the Fourier transform proved unimportant to the single step classification which were dominated by the amplitude. The phase was significant for the first step of the two step algorithm. The classification mechanisms were similar for the one step classification laws derived using 10, 30 and 200 pulses. Author (GRA)

N74-26687# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A COMPUTER SIMULATION OF A BASE TELECOMMUNICATION CENTER M.S. Thesis
William E. Glaesemann and Robert J. Robinson Jan. 1974 249 p refs
(AD-776783; SLSR-8-74A) Avail: NTIS CSCL 17/2

The purpose of the study was to examine the use of computer simulation as an analytical aid in the management of a Base Telecommunications Center. The report discusses the communications system in general and the Base Telecommunications Center in specifics. The management areas in which a computer simulation might be helpful are discussed. The nature of the populations of the variables and the problems used to define the boundaries of the system being modeled are presented and examined. The message processing times are used as a significant measure of performance in a Telecommunication Center. The simulation output is compared to the output of the WPAFB Base Telecommunications Center and the differences are discussed. The simulation output is examined to determine its usefulness in determining the effect of different types of equipment, shift schedules, and system changes. The possibility of using a simulation to determine minimum requirements in terms of personnel and equipment was examined. (Modified author abstract) GRA

N74-26688# SACLANT ASW Research Center, La Spezia (Italy).
CALCULATION OF RMS SLOPE OF CARRIER WAVES IN A COMPOSITE-ROUGHNESS SEA SURFACE MODEL
Wolfgang Bachmann 15 Jan. 1974 22 p refs
(AD-776583; SACLANTCEN-SM-38) Avail: NTIS CSCL 20/1

For calculating RADAR clutter or SONAR reverberation from the sea surface, the best results are achieved by applying a composite-roughness model. The underlying idea is that the small wavelets (ripples) primarily responsible for the backscattering are carried by longer waves with higher amplitudes (swell), which affect the scattering process in a non-linear way. It has been shown in a previous paper that the parameter describing the coupling of the long- and short-wave scattering is the rms slope of conceptual facets on the long waves. This paper develops methods for determining a suitable facet length and for calculating the rms facet slope. Author (GRA)

N74-26689# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
BQM-34A POLARIZATION CHARACTERISTICS: RADAR CROSS SECTION AND GLINT Final Report, 26 Jun. 1963 - 31 Jan. 1974
Robert W. Clay and J. Kenneth Johnston Feb. 1974 135 p refs
(Contract DAAH01-73-C-1102)
(AD-775915; FZE-1312) Avail: NTIS CSCL 17/9

The program consisted of an investigation of the radar cross section and glint signature data of a BQM-34A target drone. The CP loss as measured by the difference in the median or mean RCS value obtained within a given angular sector was found to be highly variable for the case of small angular sectors and to be approximately 2 db for the case of a large angular sector of 120 degrees centered about the nose of the vehicle. Glint data were obtained by using the discrete scatterer model developed by processing coherent short-pulse measurements data of the signature of a scale model BQM-34A. Additional glint data were obtained through use of the scattering matrix and RCS and phase measurements of an actual BQM-34A drone vehicle. (Modified author abstract) GRA

N74-26690# Cayuga Associates, Inc., Ithaca, N.Y.
NANOSECOND LSA MICROWAVE TRANSMITTER Final Report, 1 Sep. 1972 - 21 Nov. 1973
William O. Camp, Jr. Feb. 1974 40 p refs
(Contract F30602-72-C-0384)
(AD-776809; RADC-TR-73-414) Avail: NTIS CSCL 17/2

The Limited Space-charge Accumulation (LSA) mode in n-type GaAs has been considered as a source of high peak power at microwave frequencies. However, because the microwave oscillation is that of a relaxation oscillator, the frequency varies rapidly with bias voltage and temperature. This presents a problem when a high degree of frequency stability is required, and must be compensated for. Furthermore, the thicker LSA devices cause a larger thermal heating and must operate at low duty cycles. However, one can trade duty cycle for device thickness and accordingly peak and average power (20 Watts and 200 Milliwatts) is made. The methods of frequency stabilization are investigated and the one yielding the highest degree of frequency stability is investigated. A third area investigated is that of a high PRF pulser to yield the 1% duty cycle to be used. Author (GRA)

N74-26691# Pomona Coll., Claremont, Calif. Dept. of Physics.
REFLECTION OF ELECTROMAGNETIC RADIATION FROM THE OCEAN SURFACE Final Report, 1 Mar. 1973 - 1 Mar. 1974
Jack C. Miller 20 Mar. 1974 17 p refs
(Contract N00014-73-C-0304; NR Proj. 294-018)
(AD-777735; TR-1) Avail: NTIS CSCL 20/14

A method for calculating the electromagnetic field scattered from a rough, perfectly conducting surface having one-dimensional variation is presented. The calculation proceeds in two steps: (1) calculation of the current distribution on the surface via integral equation techniques, and (2) calculation of the scattered fields using these currents as sources. Shadowing and multiple scattering effects are included. Author (GRA)

N74-26692# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
AN INVESTIGATION OF REACTION SINTERED SILICON NITRIDE AS A RADOME MATERIAL Final Report, 1 Dec. 1972 - 30 Nov. 1973
Joe N. Harris, Roberto A. Arrieta, and Stanley A. Byers Dec. 1973 110 p refs

(Contract N00019-73-C-0155)
(AD-777064; GIT-A-1483) Avail: NTIS CSCL 17/9

The report discusses studies of reaction bonded silicon nitride as a candidate radome material. Using silicon powders containing up to one percent iron, reaction bonded silicon nitride was fabricated by injection molding. Fabrication methods and equipment are described as are the test techniques for thermal, mechanical and electrical evaluation. Results of dielectric tests have suggested a direct relationship between final sintered density and dielectric properties. (Modified author abstract) GRA

N74-26693# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MATHEMATICAL RESEARCH IN TARGET DETECTION AND IDENTIFICATION Final Report
W. F. Webber, S. R. Webb, and W. A. Parkyn Feb. 1974 122 p refs
(Contract F44620-71-C-0052; AF Proj. 9769)
(AD-777203; MDC-G5105; AFOSR-74-0583TR) Avail: NTIS CSCL 17/9

Contents: Fast complex demodulation; Surface matching techniques; Iterative prewhitening techniques; Radar enhancement techniques; Two-dimensional filters for signal estimation and surface matching; An eigenvector expansion for nonstationary data; The logical Walsh transform; Correlation and convolution by means of Walsh transforms; Walsh correlation routine. GRA

N74-26694# Illinois Univ., Urbana. Coordinated Science Lab.
COMPUTER SIMULATION OF ERROR CORRECTING CODES M.S. Thesis
Norman Steven Janoff Sep. 1973 149 p refs
(Contracts DAAB07-72-C-0259; DAAB07-71-C-0292; F30602-72-C-0031; Grant NSF GK-24879)
(AD-777198; R-622; UILU-ENG-73-2224) Avail: NTIS CSCL 09/4

The purpose of the thesis is to examine the error correcting ability of error-correcting codes on real communication channels. Topics discussed include the following: Bounded distance decoding; interleaved codes; error control coding based on majority-logic decoding; Reed-Solomon codes; and, diffuse threshold-decoded codes. GRA

N74-26695# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ENERGY SPECTRA FOR FREQUENCY-SHIFT-KEYED SIGNALS TRANSMITTED BY SYNCHRONOUSLY RESONATED, VERY LOW FREQUENCY ANTENNAS M.S. Thesis
Tee R. Hadley, III Dec. 1973 102 p refs
(AD-777268; GE/EE/73A-10) Avail: NTIS CSCL 17/2

Electronic broadbanding is a technique whereby very low frequency (VLF) antennas can be resonated (retuned) synchronously with a frequency-shift-keyed (FSK) signal for transmission of binary data at rates well over 1000 baud. The thesis investigates the transmitted energy density spectrum for an electronically broadbanded VLF antenna system in which a frequency shift can occur only at the instant of an antenna-current zero-crossing with positive slope. A computer solution shows that the transmitted spectrum is approximately equivalent to the spectrum of an ideal, constant amplitude, FSK signal. A further investigation, again by computer program, shows that if the total frequency shift between the marking and spacing frequencies occurs over a finite period, rather than instantaneously, then the spectrum's sidelobes will be reduced significantly. (Modified author abstract) GRA

N74-26696# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE APPLICATION OF ERROR MODELS TO THE DETERMINATION OF ERROR CAUSES IN DIGITAL CHANNELS M.S. Thesis
Jonathan P. Worthley Dec. 1973 82 p refs
(AD-777273; GE/EE/73A-33) Avail: NTIS CSCL 17/2

The purpose of this study is to determine whether the error cause present in a modem or channel can be ascertained using the parameters of matrix and renewal models of the digital channel. Data generated by a modem subjected to three major error causes, impulse hits, frequency offset, and phase jitter, were supplied by the Digital Communications Experimental Facility (DICEF), Rome Air Development Center, Griffiss AFB, New York. A simulator was used to produce the error cause in the model or channel. The parameters for Fritchman's partitioned Markov chain model, the parameters of the renewal channel model of Muntner and Wolf, and the stationary distribution and stationarity of the transition probabilities for the error-free run model are used to determine the cause of errors. This study indicates that they can be used for this purpose. Author (GRA)

N74-26697*# Texas A&M Univ., College Station. Remote Sensing Center.
RADAR STUDIES OF ARCTIC ICE AND DEVELOPMENT OF A REAL-TIME ARCTIC ICE TYPE IDENTIFICATION SYSTEM Final Report, Sep. 1971 - Jun. 1973
J. W. Rouse, Jr., J. A. Schell, and J. A. Permenter Jun. 1973 244 p refs Sponsored in part by NASA
(Contract N60921-72-C-0076)
(NASA-CR-138694; AD-775249; RSC-835-6) Avail: NTIS HC $15.25 CSCL 08L

Studies were conducted to develop a real-time Arctic ice type identification system. Data obtained by NASA Mission 126, conducted at Pt. Barrow, Alaska (Site 93) in April 1970 was analyzed in detail to more clearly define the major mechanisms at work affecting the radar energy illuminating a terrain cell of sea ice. General techniques for reduction of the scatterometer data to a form suitable for application of ice type decision criteria were investigated, and the electronic circuit requirements for implementation of these techniques were determined. Also, consideration of circuit requirements are extended to include the electronics necessary for analog programming of ice type decision algorithms. After completing the basic circuit designs a laboratory model was constructed and a preliminary evaluation performed. Several system modifications for improved performance are suggested. (Modified author abstract) GRA

N74-26698# Test Group (6585th), Holloman AFB, N.Mex.
RADAR CROSS SECTION MEASUREMENTS OF A BQM-34F TARGET DRONE, VOLUME 3B
Carroll R. Griffin Oct. 1973 522 p
(AD-777150; AFSWC-TR-72-20-Vol-3B) Avail: NTIS CSCL 17/9

Static radar cross section data were acquired from a BQM-34F remotely piloted vehicle (RPV) at the U. S. Air Force Radar Target Scatter Facility, (RAT SCAT), 6585th Test Group, Holloman AFB, New Mexico. The BQM-34F vehicle was configured to provide comparison data for several combinations of RCS and/or Infrared (IR) augmentation pods. Both monostatic and 10 degree bistatic data were obtained for eight vehicle roll angles and six vehicle pitch angles. Horizontal and vertical polarizations were used at a frequency of 9130 MHz. The report contains a description of the measurement conditions as well as reproductions of the raw and processed data acquired. (Modified author abstract) GRA

N74-26699# Stanford Research Inst., Menlo Park, Calif.
DNA PROJECT 617 RADAR: AURORAL IONOSPHERIC MEASUREMENTS Final Report, Dec. 1972 - Dec. 1973
Murray J. Baron Jan. 1974 76 p refs
(Contract DNA001-72-C-0076; SRI Proj. 1703)
(AD-777075; DNA-3292T) Avail: NTIS CSCL 17/9

The report summarizes the 1973 SRI research efforts associated with the Chatanika incoherent-scatter radar. Additions and improvements to the radar hardware are described. New software and modifications to existing software were implemented. The functions of these programs are described. Over 180 hours of data were recorded during the year and the dates, times, and purposes of radar operation are listed. The research results are summarized in the form of abstracts of papers that have resulted from the project efforts. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-26700# National Bureau of Standards, Washington, D.C. Systems and Software Div.
RESEARCH CONSIDERATIONS IN COMPUTER NETWORKING TO EXPAND RESOURCE SHARING
Dennis W. Fife Jun. 1974 24 p refs Sponsored by NSF
(NBS-TN-801) Avail: SOD HC $0.60 as c13.46:801

Computer networking technology is presented. Experimentation to expand computing resource sharing is discussed. Whether progress will be made depends upon organizational initiative among multiple institutions, to pool personnel and capital so as to effectively address the major issues in management approach, support and software design that limit the feasible interdependence of computing operations. The organizational requirements are partially revealed by examining progressive stages of resource sharing in organizational and operational terms rather than such technical aspects as load sharing or program sharing that have been introduced in the past. Five stages are identified, ranging from simply establishing multiple service access to the advanced stage where multiple institutions organize for joint development of new resources. A preliminary evaluation framework for new management arrangements results when these stages are mapped against the four functional levels inherent in computer network management. Future needs for networking experimentation and research are briefly described, and other NBS technical results are identified in context. Author

N74-26701*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
REAL-TIME MINIMAL BIT ERROR PROBABILITY DECODING OF CONVOLUTIONAL CODES
Lin-nan Lee 25 Jul. 1973 18 p refs
(Grant NGL-15-004-026)
(NASA-CR-138661; EE-7312) Avail: NTIS HC $4.00 CSCL 09B

A recursive procedure is derived for decoding of rate $R = 1/n$ binary convolutional codes which minimizes the probability of the individual decoding decisions for each information bit subject to the constraint that the decoding delay be limited to Delta branches. This new decoding algorithm is similar to, but somewhat more complex than, the Viterbi decoding algorithm. A real-time, i.e. fixed decoding delay, version of the Viterbi algorithm is also developed and used for comparison to the new algorithm on simulated channels. It is shown that the new algorithm offers advantages over Viterbi decoding in soft-decision applications such as in the inner coding system for concatenated coding. Author

N74-26702# State Univ. of New York, Buffalo. Dept. of Mechanical Engineering.
AN EVALUATION OF OPTIMIZATION TECHNIQUES FOR APPLICATIONS IN ENGINEERING DESIGN
K. A. Afimiwala and R. W. Mayne 6 May 1974 170 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Spacecraft and Rockets in Oct. 1974
Avail: NTIS HC $11.50

A package of general and efficient computer programs for solving optimization problems is presented. Powerful unconstrained optimization methods were used which are based on the ideas of quadratic convergence and conjugate directions. These programs were tested for convergence and efficiency by using typical test functions. The Davidon-Fletcher-Powell variable metric method was found to be successful in determining the unconstrained optimum. Programs for solving constrained optimization problems are based on the ideas of penalty functions and feasible directions. Results of a comparative study of constrained optimization methods indicated that sequential penalty function methods, with a gradient based search procedure using finite difference gradient computations, perform well on most problems. Author

N74-26703*# Raytheon Co., Sudbury, Mass. Equipment Development Lab.
RELIABILITY MODEL DERIVATION OF A FAULT-TOLERANT, DUAL, SPARE-SWITCHING, DIGITAL COMPUTER SYSTEM Final Report
25 Mar. 1974 352 p refs
(Contract NAS1-12668)
(NASA-CR-132441; ER74-4108) Avail: NTIS HC $20.75 CSCL 09B

A computer based reliability projection aid, tailored specifically for application in the design of fault-tolerant computer systems, is described. Its more pronounced characteristics include the facility for modeling systems with two distinct operational modes, measuring the effect of both permanent and transient faults, and calculating conditional system coverage factors. The underlying conceptual principles, mathematical models, and computer program implementation are presented. Author

N74-26704*# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
[COMPUTER-ASSISTED INSTRUCTION] Final Report
Richard C. Atkinson 1 Jun. 1974 392 p refs
(Grant NGR-05-020-547)
(NASA-CR-138667) Avail: NTIS HC $22.75 CSCL 09B

The results are presented of a project of research and development on strategies for optimizing the instructional process, and dissemination of information about the applications of such research to the instructional medium of computer-assisted instruction. Accomplishments reported include construction of the author language INSTRUCT, construction of a practical CAI course in the area of computer science, and a number of investigations into the individualization of instruction, using the course as a vehicle. For individual titles, see N74-26705 through N74-26710.

N74-26705* Stanford Univ., Calif.
COMPUTER-ASSISTED INSTRUCTION IN PROGRAMMING: AID
Jamesine E. Friend and R. C. Atkinson *In its* Computer-Assisted Instruction 1 Jun. 1974 86 p refs (For availability see N74-26704 16-08)
(Grant NGR-05-020-244)
CSCL 09B

A study was instituted to design and produce a course in programming using a computer-assisted instruction as the instructional medium. The requirements for the course were that it be tutorial in nature, sufficiently self-contained so that students could use it without being supervised by an experienced teacher of programming, and be suitable for use by NASA personnel. A preliminary version was completed and consisted of a coding language, a set of 20 one-hour lessons written in the coding language, and a set of programs to interpret coded lessons and to interact with students using standard teletypes as student stations. A description of the course, some preliminary results from its pilot period of development, and a discussion of computer programs and coding languages are presented. Author

N74-26706* Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
STUDENT PERFORMANCE IN COMPUTER-ASSISTED INSTRUCTION IN PROGRAMMING
J. E. Friend, J. D. Fletcher, and R. C. Atkinson *In its* Computer-Assisted Instruction 1 Jun. 1974 89 p refs (For availability see N74-26704 16-08)
CSCL 09B

An instructional system for teaching the Algebraic Interpretive Dialogue (AID) programming language to college-age students, two control programs (one for presenting instructional material and one for interpreting students' AID productions), and data collected by the two control programs are described. The first 21 lessons of the course and classification of the lesson exercises are also described. Data based on student daily reports are presented and discussed. Item analyses of data gathered by the instructional program, including stepwise linear regression models of item difficulty and analyses of selected data collected by the interpreting program are also presented and discussed. Author

N74-26707* Stanford Univ., Calif.
PROVIDING SOFTWARE SUPPORT FOR COMPUTER-ASSISTED INSTRUCTION
J. D. Fletcher and R. W. Schulz *In its* Computer-Assisted Instruction 1 Jun. 1974 10 p Presented at Computer Sci. Conf., Columbus, Ohio, 20-22 Feb. 1973 (For availability see N74-26704 16-08)

(Grant NGR-05-020-547)
CSCL 09B

A set of common issues have been observed to arise whenever the question of computer-assisted instruction comes up. These issues are documented and specific suggestions are made for adopting extant time-sharing systems for computer-assisted instruction. Author

N74-26708* Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
COMPUTER-ASSISTED INSTRUCTION IN PROGRAMMING: A CURRICULUM DESCRIPTION
Jamesine E. Friend *In its* Computer-Assisted Instruction 1 Jun. 1974 79 p refs (For availability see N74-26704 16-08)
CSCL 09B

The described course provides an introduction to computer programming for community college students who have taken high school algebra. The organization of the course, types of exercises used, and content of each lesson are documented. The concepts associated with each exercise in the course are listed. Author

N74-26709* Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
SOME 100 PROGRAMMING PROBLEMS: WITH A DESCRIPTION OF THE PROGRAMMING LANGUAGE AID
Jamesine E. Friend *In its* Computer-Assisted Instruction 1 Jun. 1974 57 p (For availability see N74-26704 16-08)
CSCL 09B

The 100 problems considered were prepared for students taking a computer-assisted course in introductory algebraic programming. The problems include applications of elementary programming techniques to a variety of fields such as elementary arithmetic and algebra, geometry, linear algebra, probability and statistics, consumer and business problems, and calculus. A brief reference manual for the programming language AID is included. Author

N74-26710* Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
COMPARISON OF STUDENT PERFORMANCE AND ATTITUDE UNDER THREE LESSON-SELECTION STRATEGIES IN COMPUTER-ASSISTED INSTRUCTION
Marian H. Beard, Paul V. Lorton, Barbara W. Seairle, and R. C. Atkinson *In its* Computer-Assisted Instruction 1 Jun. 1974 63 p refs (For availability see N74-26704 16-08)
CSCL 09B

Three problem selection strategies (student selection, program selection weighted by past performance, and forced selection independent of students history) were compared in a CAI course in computer programming. Various measures of aptitude, performance, and attitude were examined. No consistent difference was observed among the three groups. The results are discussed in terms of the specific experiment and the general problem of curriculum design for comparing path selection strategies. Continuing experimentation is described. Author

N74-26711*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
PLATED WIRE MEMORY SUBSYSTEM Final Report, Oct. 1972 - Feb. 1974
Ken H. Carpenter Feb. 1974 244 p
(Contract NAS5-23163)
(NASA-CR-139015) Avail: NTIS HC $15.25 CSCL 09B

The design, construction, and test history of a 4096 word by 18 bit random access NDRO Plated Wire Memory for use in conjunction with a spacecraft input/output and central processing unit is reported. A technical and functional description is given along with diagrams illustrating layout and systems operation. Test data is shown on the procedures and results of system level and memory stack testing, and hybrid circuit screening. A comparison of the most significant physical and performance characteristics of the memory unit versus the specified requirements is also included. A.A.D.

N74-26712*# Michigan Univ., Ann Arbor. Dept. of Computer and Communication Sciences.
STUDY OF GENETIC DIRECT SEARCH ALGORITHMS FOR FUNCTION OPTIMIZATION Final Report
Bernard P. Zeigler Jun. 1974 9 p
(Grant NGR-23-005-009)
(NASA-CR-138619) Avail: NTIS HC $4.00 CSCL 09B

The results are presented of a study to determine the performance of genetic direct search algorithms in solving function optimization problems arising in the optimal and adaptive control areas. The findings indicate that: (1) genetic algorithms can outperform standard algorithms in multimodal and/or noisy optimization situations, but suffer from lack of gradient exploitation facilities when gradient information can be utilized to guide the search. (2) For large populations, or low dimensional function spaces, mutation is a sufficient operator. However for small populations or high dimensional functions, crossover applied in about equal frequency with mutation is an optimum combination. (3) Complexity, in terms of storage space and running time, is significantly increased when population size is increased or the inversion operator, or the second level adaptation routine is added to the basic structure. D.L.G.

N74-26713*# TRW Systems Group, Houston, Tex.
ASTEP USER'S GUIDE AND SOFTWARE DOCUMENTATION
A. S. Gliniewicz, H. M. Lachowski, W. H. Pace, Jr., and P. Salvato, Jr. 15 May 1974 280 p refs
(Contract NAS9-13834)
(NASA-CR-134303; TRW-25990-H028-RO-00; TRW-Note-74-FMT-939) Avail: NTIS HC $19.50 CSCL 05B

The Algorithm Simulation Test and Evaluation Program (ASTEP) is a modular computer program developed for the purpose of testing and evaluating methods of processing remotely sensed multispectral scanner earth resources data. ASTEP is written in FORTRAND V on the UNIVAC 1110 under the EXEC 8 operating system and may be operated in either a batch or interactive mode. The program currently contains over one hundred subroutines consisting of data classification and display algorithms, statistical analysis algorithms, utility support routines, and feature selection capability. The current program can accept data in LARSC1, LARSC2, ERTS, and Universal formats, and can output processed image or data tapes in Universal format. Author

N74-26714# RAND Corp., Santa Monica, Calif.
GAMING: PROSPECTIVE FOR FORECASTING
Garry D. Brewer Feb. 1974 46 p refs
(P-5178) Avail: NTIS HC $5.50

Despite its venerability, gaming has many unrecognized and unrealized potentials; unrecognized because, among other reasons, several fundamental conceptual issues have not been well or thoroughly developed and unrealized because many fundamental questions remain unanswered. Concepts and questions are developed and raised, respectively, and several directions for research in the international relations setting are sketched out, including technical issues related to game size, supporting data, and methods of validation, and substantive issues related to terrorism, crisis decision making, deception, and war's termination. Author

N74-26715# RAND Corp., Santa Monica, Calif.
COMPUTERS IN THE 1980'S: TRENDS IN HARDWARE TECHNOLOGY
Rein Turn Mar. 1974 17 p refs
(P-5189) Avail: NTIS HC $4.00

A technological forecast is presented of computer hardware trends in the 1975 to 1990 time period. Projected improvements are projected in switching speed, power consumption, cost, and physical size of bipolar and metal-oxide semiconductor logic circuits. Based on these, the computing speed of processors for several computer architectures are forecast; uniprocessors, pipeline processors, array processors, associative array processors, and for command-control, multiprocessors. The storage capacity and access time improvements are projected for semiconductor random-access memories, and summarized for other solid-state memory component technologies. The paper concludes with a discussion of innovations in computer system design and use which become feasible due to the expected hardware developments. Author

N74-26716# Sandia Labs., Albuquerque, N.Mex. Theoretical Div.
EFFICIENT COMPUTER ACCESS TO THE SANDIA PHOTON CROSS SECTIONS
K. G. Adams and F. Biggs Dec. 1973 67 p refs
(Contract AT(29-1)-789)
(SC-RR-72-683) Avail: NTIS HC $5.50

The computer program SIGMA is described and illustrated. This program provides photon cross sections for use in various kinds of engineering problems, as well as some routines for processing cross sections for use in transport codes. A brief description is given of the analytical approximations used to obtain numerical values of the cross sections. SIGMA is available on permanent files for use on the CDC 6600. Author (NSA)

N74-26717# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
AN INTERFACE FOR AN AUDIO CASSETTE RECORDER AS PERIPHERAL FOR THE PDP-8 [EEN INTERFACE VOOR EEN AUDIOCASSETTERECORDER ALS RANDAPPARAAT VOOR DE PDP-8]
G. F. Jorritsma and W. R. M. Kok May 1972 31 p refs In DUTCH
(SL-285) Avail: NTIS HC $4.75

The development of an interface allowing a normal audio cassette recorder to be used as the input/output device of a PDP-8 minicomputer is described. The objective was to obtain a cheaper and faster peripheral than the normal teletype. Two versions were developed. The first processes information per bit and converts the 12 bit words of the PDP-8 computer into sequential form and vice versa. The second version is equipped with series-parallel converters so that the information can be input in parallel form with the advantage that a program interrupt is required only once every 1.2 ms. The first version requires a program interruption once every 0.2 ms. Author (ESRO)

N74-26718# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
REFERENCE COLLECTION OF DIGIT PATTERNS
A. A. Spanjersberg, J. VanStaveren, and J. F. VanBilzem Apr. 1972 90 p
(IL-289) Avail: NTIS HC $7.50

In connection with an investigation of the possibilities of reading numerical data automatically, a collection of digit patterns was built up. The digit patterns were recorded on magnetic tape after quantization in discrete picture elements. The first edition of the reference collection will contain exclusively handwritten digit patterns. Author (ESRO)

N74-26719# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
MINITRACER FOR TSS/8-TIME SHARING [MINITRACER T.B.V. TSS/8-TIME SHARING]
P. M. VanNieuwaland Aug. 1972 13 p In DUTCH
(IL-291) Avail: NTIS HC $4.00

A trace program for the PDP-8 time sharing system was written with the following specifications: minor core occupation; all instructions must be dealt with; and instruction counter, instruction, link, and accumulator must appear in output. The program listing in Assembler language is given. Author (ESRO)

N74-26720# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
HARDWARE COMMAND AND CONTROL SYSTEM STUDY Final Technical Report, 18 Jun. - 18 Dec. 1973
J. R. Fogarty, J. H. Rowan, D. A. Smith, and M. D. Swesen 18 Feb. 1974 117 p
(Contract N00123-73-C-2130)
(AD-776640; FR-74-11-20) Avail: NTIS CSCL 09/2

The report specifies a controlling entity termed the Hardware Command and Control Manager (HCCM) which integrates and controls the activities of distributed processes. The processes controlled by the HCCM may vary in level of complexity from a special purpose hardware function, through the process realized as mini-computers, to large scale processing systems requiring large central processors. The control functions provided by the HCCM are executive or operating system functions found in traditional software systems. The software functions in this class which are appropriate are optimized through implementation in hardware and form the HCCM. These functions are delineated in detail in this report along with the hardware blocks necessary to perform these operations. Author

N74-26721# Stanford Univ., Calif. Dept. of Computer Science.
THE FIRST TEN YEARS OF ARTIFICIAL INTELLIGENCE RESEARCH AT STANFORD Final Report
Lester Earnest Jul. 1973 119 p
(Contract SD-183)
(AD-776233; STAN-CS-74-409; AIM-228) Avail: NTIS CSCL 06/4

The first ten years of research in artificial intelligence and related fields at Stanford University have yielded significant results in computer vision and control of manipulators, speech recognition, heuristic programming, representation theory, mathematical theory of computation, and modelling of organic chemical processes. The report summarizes the accomplishments and provides bibliographies in each research area. Author (GRA)

N74-26722# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN AUTOMATIC SCALING DEVICE FOR ANALOG INPUT SIGNALS IN A COMPUTER DATA ACQUISITION SYSTEM Final Report
J. J. Rocchio and E. M. Vogel Mar. 1974 16 p refs
(DA Proj. 1T1-61102-A-32C)
(AD-775807; BRL-MR-2354) Avail: NTIS CSCL 14/2

A device which automatically scales an input signal to an analog to digital converter (ADC) has been developed. It consists of a voltage comparator which, depending on the signal level, switches to one of two operational amplifier inputs having a gain of one and eight respectively. When the unity gain amplified input is selected a flag is set which signals the computer to multiply the value when read by eight. This extends the dynamic range of a system using a 12 bit ADC (resolution 1 part in 4096) from 4095 to 32760. The benefits are a significant decrease in the dwell time per measurement and the amount of software overhead needed to make a scaled reading of an ADC. Other applications of this technique include automatic presentation of data as a 12 bit magnitude and 3 bit binary exponent which could extend the dynamic range to 524,000. This technique may be extended to an ADC of less than 12 bits resolution and therefore to computers with word lengths less than 16 bits.
Author (GRA)

N74-26723# System Development Corp., Santa Monica, Calif.
INTERACTIVE SYSTEMS RESEARCH Final Report, 16 Sep. 1972 - 30 Sep. 1973
Morton I. Bernstein 30 Nov. 1973 77 p refs
(Contract DAHC15-73-C-0080; ARPA Order 2254)
(AD-776236; SDC-TM-5243/000/00) Avail: NTIS CSCL 09/2

The report documents research in five areas of applied computing: (1) speech understanding, (2) the use of inference in data management, (3) image and signal processing, (4) network research and development (including ARPA Network activities), and (5) network data management. Research activities reported upon include the development and demonstration of a prototype Voice Data Management System; the design of an interactive, graphics-oriented system for use by image analysis; and several approaches to amplifying the power and flexibility of the data management process and data management languages. All of these activities are focused on the man-machine interface and specifically on ways of making it more natural and adaptable to the needs and preferences of users. Author (GRA)

N74-26724# Army Signal Center And School, Fort Monmouth, N.J.
AN ON-LINE ELECTRONICS GRAPHIC SYMBOL SET FOR THE PLATO 4 COMPUTER SYSTEM
Peggy A. McClintock and Donald A. Kimberlin Oct. 1973 61 p Sponsored by ARPA
(AD-776364; CTS-TR-73-3) Avail: NTIS CSCL 09/2

An electronics graphics symbol set for on-line construction of electrical and electronics schematic diagrams is described. Specific procedures involving off-line and on-line activities are

presented for the development and entry of schematic diagrams using a stored set of symbols. An example of the commands and coding required for the construction of diagrams is provided. Author (GRA)

N74-26725# Pattern Analysis and Recognition Corp., Rome, N.Y.
MULTISPECTRAL ANALYSIS SOFTWARE Final Report, Jul. 1972 - Jun. 1973
John C. Lietz, Alexander J. Zanon, Gerald T. Stevens, Robert E. Bozek, and Bruce K. Optiz Nov. 1973 865 p refs
(Contract F30602-72-C-0521)
(AD-776298; RADC-TR-73-339) Avail: NTIS CSCL 09/2

The report is prepared in the form of a User's Manual for personnel engaged in the operation of the RADC SCORE (Spectral Combinations for Reconnaissance Exploitation) system. The SCORE program has as its major objective the development and implementation of a multispectral analysis system to identify military targets based on their spectral signature. The specific objective of the subjective contract was the development and implementation of applications of software in the form of preprocessing and analysis routines for use in extracting spectral signatures (features) from multispectral data. The spectral features are intended for use on the On-Line Pattern and Recognition System (OLPARS) in the design of enhancement/recognition logic for targets of interest. Parallel to the development of the SCORE program has been the development of the Image Feature Extraction System (IFES). IFES is being implemented as a research tool for use in extracting information from a single image based on the spatial characteristics of targets. SCORE and IFES reside within one software framework in the PDP-11/20/SDS-800 system. (Modified author abstract) GRA

N74-26726# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
QUASI-STATIC CAPACITANCE-VOLTAGE CHARACTERISTICS OF MNOS DEVICES M.S. Thesis
George W. Trever Dec. 1973 106 p refs
(AD-777586; GE/EE/73A-30) Avail: NTIS CSCL 09/2

The quasi-static (low-frequency) capacitance-voltage (CV) characteristics of metal-nitride-oxide-semiconductor (MNOS) memory devices are shown to exhibit distinguishable properties associated with memory and nonmemory behavior. Quasi-static CV analysis procedures, as developed by Kuhn, are applied to the MNOS nonmemory characteristics and reveal that the silicon-oxide interface-state densities are 100 times larger than for comparable nonmemory capacitor structures. Substrate surface-potential functions are constructed to model ideal nonmemory CV behavior and are used to compare with memory CV characteristics. Calculations are performed to show that the switching behavior observed experimentally is consistent with the quasi-static CV memory characteristics and with the mathematical models. Also, nonequilibrium quasi-static effects observed for MNOS memory transistor structures and deviations in normal quasi-static CV behavior of MNOS nonmemory capacitor structures are reported. Author (GRA)

N74-26727# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN EXPANSION OF THE D17B COMPUTER FACILITY M.S. Thesis.
Duane B. Reynolds Nov. 1973 153 p refs
(AD-777584; GE/EE/73A-21) Avail: NTIS CSCL 09/2

Several years ago, the Electrical Engineering department of the Air Force Institute of Technology School of Engineering initiated a research program to investigate and demonstrate the feasibility of converting the Minuteman I ICBM D17B guidance computer into a general purpose minicomputer. This report, as part of a continuing effort to determine the extent to which the capabilities of the computer can be applied to a general-purpose information processing tasks, presents the results of a study of the memory writing circuitry of the machine. The study was conducted to investigate the possibility of installing a two-way Direct Memory Access (DMA) capability in the AFIT D17B. The study forms the basis for a design proposal for such a DMA facility for the AFIT D17B complex. This proposal is fully defined in register transfer language and other logic expressions before being presented in a hardware realization. Author (GRA)

N74-26728# Aerospace Corp., El Segundo, Calif.
A COMPARISON OF FAULT-TOLERANT AND EXTERNALLY REDUNDANT COMPUTERS
H. Hecht 25 Jan. 1974 41 p refs
(Contract F04701-73-C-0074)
(AD-777166; TR-0074(4112)-1; SAMSO-TR-74-66) Avail: NTIS CSCL 09/2

The reliability of fault-tolerant and externally redundant computers is compared with reference to long-duration space missions. Technology, computer performance, and reliability assumptions are equal for all configurations. It is then found that the postulated fault-tolerant computer requires about four times the resources of an equivalent simplex design. An active and spares configuration and a voting configuration of four simplex computers are compared to the fault-tolerant computer. For mission durations of three years or longer the fault-tolerant design has a significant reliability advantage. For five-year missions the reliabilities are as follows: Fault-tolerant 0.9530, Active and spares 0.4920, Voting 0.1918. Author (GRA)

N74-26729# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CONVERSION OF THE D37C COMPUTER FOR GENERAL PURPOSE APPLICATIONS M.S. Thesis
Dennis C. Reguli Mar. 1974 172 p refs
(AD-777244; GE/EE/74-16) Avail: NTIS CSCL 09/2

The report addresses the problem of reutilizing later Minuteman computers, D37C's, which will become surplus in the near future. Revitilization is assumed optimum by first converting into a general purpose minicomputer. This is done for the D37C by supplying external support systems, control and monitor circuits, and expanded I/O capability. The external systems include power supplies and cooling system and were provided at AFIT by laboratory generators and a fan and pump assembly, respectively. (Modified author abstract) GRA

N74-26730# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A CATHODE RAY TUBE DISPLAY SYSTEM FOR A MINUTEMAN 1 COMPUTER M.S. Thesis
Thomas N. Trimble 19 Dec. 1973 134 p refs
(AD-777272; GE/EE/73A-31) Avail: NTIS CSCL 09/2

Since the Electrical Engineering department of the Air Force Institute of Technology acquired two of the Air Force's surplus D17B Minuteman I computers June of 1971, considerable effort has been expended toward converting these into a general purpose laboratory computer system. This report describes the considerations which must be evaluated in designing a computer display system. Many of the different types of commercial display systems and how they operate are discussed. The design of an alphanumeric cathode ray tube display sustem and the reasoning followed during this design effort is presented in this thesis. The logic schematics and the components required for constructing and interfacing this alphanumeric display system with the D17B computer system are included as a part of this pro-

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N74-26731# Office of the Assistant Director (Electro. Physical Sciences). Defense Research and Engineering. ... ton, D.C.
REPORT OF AN AD HOC REVIEW OF AMORPHOUS SEMICONDUCTOR MEMORY TECHNOLOGY
Aug. 1973 18 p
(AD-777726) Avail: NTIS CSCL 09/2

The report discusses the performance specifications of the leading EAROM (Electrically Alterable Read Only Memories) Technologies. GRA

N74-26564 Joint Publications Research Service, Arlington, Va.
USE OF AN M-220 ELECTRONIC COMPUTER FOR AUTOMATIC PROCESSING OF EXTERNAL RESPIRATION PARAMETERS
L. A. Rustamyan, N. I. Vikhrov, V. D. Skosyreva, and L. R. Iseyev *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 94-95 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 230-232 (For availability see N74-26527 16-04)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-26732* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LC-OSCILLATOR WITH AUTOMATIC STABILIZED AMPLITUDE VIA BIAS CURRENT CONTROL Patent
John F. Hamlet, inventor (to NASA) Issued 4 Jun. 1974 6 p Filed 15 Jun. 1973 Supersedes N73-26196 (11 - 17, p 2003)
(NASA-Case-MFS-21698-1; US-Patent-3,815,048; US-Patent-Appl-SN-37050; US-Patent-Class-331-109; US-Patent-Class-331-117R; US-Patent-Class-331-183) Avail: US Patent Office CSCL 09A

A stable excitation supply for measurement transducers is described. It consists of a single-transistor oscillator with a coil connected to the collector and a capacitor connected from the collector to the emitter. The output of the oscillator is rectified and the rectified signal acts as one input to a differential amplifier; the other input being a reference potential. The output of the amplifier is connected at a point between the emitter of the transistor and ground. When the rectified signal is greater than the reference signal, the differential amplifier produces a signal of polarity to reduce bias current and, consequently, amplification. Official Gazette of the U.S. Patent Office

N74-26733# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A DECOUPLING SUPPLY NETWORK FOR SMALL ANTENNA ARRAYS
E. Noering and V. Riech Mar. 1973 8 p ref Transl. into ENGLISH from Arch. Electron. Ubertragungstechnik (West Germany), v. 26, no. 10, 1972 p 451-453
(NTC-74-11884; Rept-73-107) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The design of a decoupling network for an array of two aperture antennas is described. It is shown that this array can be controlled with respect to phase. Author

N74-26734# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FREQUENCY AND POWER LIMITS OF FIELD-EFFECT TRIODES. APPLICATION TO THE GRIDISTOR
S. Teszner May 1973 39 p refs Transl. into ENGLISH from Ann. Telecommun. (France), v. 26, no. 7/8, 1971 p 303-314
(NTC-74-11883; Rept-73-134) Avail: NTIS HC $5.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Intrinsic and practical limits in operating frequency and output power-frequency product of field-effect triodes are investigated. The introduction of parasitic elements leads to a determination of the practical limitations. Author

N74-26735# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN IMPROVED THEORY FOR THE CALCULATION OF THE LOGARITHMIC SPIRAL ANTENNA
R. Anders Jan. 1973 8 p refs Transl. into ENGLISH from proceedings of conf. on Antennas: Specialists Meeting (West Germany), 22-24 Feb. 1972 p 186-190
(NTC-74-50417; Rept-73-33) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A theory was developed to explain an anomaly of the radiation zone of the radiation mechanism of spiral antennas. The theory makes it possible to calculate all characteristic antenna properties, and in particular the antenna near field. The numerical analysis is based on a method which solves the boundary value problem of the logarithmic spiral antenna by integral equation methods and is suitable for evaluation on large digital computers. Author

N74-26736# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NOVEL DIELECTRIC RADIATORS
F. Landstorfer, H. Meinke et al Jan. 1973 9 p Transl. into ENGLISH from proceedings of conf. on Antennas: Specialists Meeting (West Germany), 22-24 Feb. 1972 p 151-156
(NTC-74-50416; Rept-73-34) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The characteristics of narrow band and wide band antenna systems are discussed. Two essential aspects of the dielectric antennas considered are: (1) the electromagnetic waves to be radiated are generated directly in the dielectric and (2) the geometrical dimensions of the described antennas are comparable in order of magnitude with one wavelength in air. The configurations of the antennas are illustrated. Diagrams of the antenna radiation patterns for various frequencies are provided. Author

N74-26737*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH PERFORMANCE dc-dc CONVERSION WITH VOLTAGE MULTIPLIERS
W. T. Harrigill and I. T. Myers 1974 6 p refs Presented at Power Electron. Specialists Conf., Murray Hill, N. J., 10-12 Jun. 1974; Sponsored by IEEE
(NASA-TM-X-71566) Avail: NTIS HC $3.00 CSCL 09E

The voltage multipliers using capacitors and diodes first developed by Cockcroft and Walton in 1932 were reexamined in terms of state of the art fast switching transistors and diodes, and high energy density capacitors. Because of component improvements, the voltage multiplier, used without a transformer, now appears superior in weight to systems now in use for dc-dc conversion. An experimental 100-watt 1000-volt dc-dc converter operating at 100 kHz was built, with a component weight of about 1 kg/kW. Calculated and measured values of output voltage and efficiency agreed within experimental error. Author

N74-26738*# Ohio State Univ., Columbus. ElectroScience Lab.
ELECTROMAGNETIC AND SCALAR DIFFRACTION BY A RIGHT-ANGLED WEDGE WITH A UNIFORM SURFACE IMPEDANCE
Y. M. Hwang Washington NASA May 1974 91 p refs
(Grant NGR-36-008-144)
(NASA-CR-2404; ESL-3001-6) Avail: NTIS HC $4.00 CSCL 09E

The diffraction of an electromagnetic wave by a perfectly-conducting right-angled wedge with one surface covered by a dielectric slab or absorber is considered. The effect of the coated surface is approximated by a uniform surface impedance. The solution of the normally incident electromagnetic problem is facilitated by introducing two scalar fields which satisfy a mixed boundary condition on one surface of the wedge and a Neumann of Dirichlet boundary condition on the other. A functional transformation is employed to simplify the boundary conditions so that eigenfunction expansions can be obtained for the resulting Green's functions. The eigenfunction expansions are transformed into the integral representations which then are evaluated asymptotically by the modified Pauli-Clemmow method of steepest descent. A far zone approximation is made to obtain the scattered field from which the diffraction coefficient is found for scalar plane, cylindrical or sperical wave incident on the edge. With the introduction of a ray-fixed coordinate system, the dyadic diffraction coefficient for plane or cylindrical EM waves normally indicent on the edge is reduced to the sum of two dyads which can be written alternatively as a 2 X 2 diagonal matrix. Author

N74-26739*# Ohio State Univ., Columbus. ElectroScience Lab.
TM SURFACE WAVE DIFFRACTION BY A TRUNCATED DIELECTRIC SLAB RECESSED IN A PERFECTLY CONDUCTING SURFACE
P. H. Pathak and R. G. Kouyoumjian Washington NASA May 1974 128 p refs
(Grant NGR-36-008-144)
(NASA-CR-2402; ESL-3001-4) Avail: NTIS HC $4.75 CSCL 09C

The diffraction of a TM sub o surface wave by a terminated dielectric slab which is flush mounted in a perfectly conducting surface is studied. The incident surface wave gives rise to waves reflected and diffracted by the termination; these reflected and diffracted fields may be expressed in terms of the geometrical theory of diffraction by introducing surface wave reflection and diffraction coefficients which are associated with the termination. In this investigation, the surface wave reflection and diffraction coefficients have been deduced from a formally exact solution

to this canonical problem. The solution is obtained by a combination of the generalized scattering matrix technique and function theoretic methods. Author

N74-26740*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-EFFICIENCY, 200 WATT, 12-GIGAHERTZ TRAVELING WAVE TUBE
Henry G. Kosmahl, B. D. McNary (Litton Industries, San Carlos, Calif.), and Otto Sauseng (Litton Industries, San Carlos, Calif.) Washington Jun. 1974 18 p refs
(NASA-TN-D-7709; E-7910) Avail: NTIS HC $3.00 CSCL 09A

Design and performance of a highly efficient experimental 200-watt traveling wave tube for space communications are described. The tube uses a coupled cavity slow wave structure with periodic permanent magnet focusing. A two-step velocity taper is incorporated in the slow wave structure for velocity resynchronization with the modulated beam. The spent beam is reconditioned in a refocusing section before it is collected in a novel multistage depressed collector. The collector is radiation cooled and heat insulated from the tube body. At saturation the tube provides peak output power of 240 watts with a 35-db gain and an overall maximum efficiency of 56 percent. Author

N74-26741# Defence Research Establishment Valcartier (Quebec).
A SEMICONDUCTOR SKYLIGHT OPTICAL SCREEN FOR PROJECTILE DETECTION
J. M. Cruickshank Feb. 1974 21 p refs
(DREV Proj. 99-10-33)
(DREV-TN-2100/74) Avail: NTIS HC $4.25

The design, detection capabilities, and testing procedures are presented for a wide-angle skylight optical screen primarily intended for use in the measurement of projectile velocity and retard on outdoor ranges. Semiconductor electronics were used to construct the unit which is suited for use in remote areas where it is advantageous to employ a light, easily portable instrument designed for operation from either a low voltage battery source or 100 VAC power line. Author

N74-26742# Sandia Labs., Albuquerque, N.Mex.
ION MICROPROBE TECHNIQUES USED IN THE IDENTIFICATION OF AgCl AS A SURFACE CONTAMINANT ON HYBRID MICROCIRCUIT CAPACITORS
J. W. Guthrie Dec. 1973 22 p
(Contract AT(29-1)-789)
(SLA-73-1014) Avail: NTIS HC $3.25

An ion microprobe mass analyzer was used for the identification analysis of a micron sized surface contaminant on hybrid microcircuit barium titanate capacitors with silver frit terminations. A 20-keV O2(+) sputtering ion beam was used to obtain characteristic positive and negative sputtered ion mass spectra, scanning ion micrographs, and depth profiles from clean and contaminated capacitors. The spectra from the contaminated capacitors contained significant peaks for AgOh(+), BaCl(+), Ag2(+), Ag2OH(+), Ag2Cl(+), and Cl(-) sputtered ion species. On the clean capacitors these species were detected only as low intensity peaks or not at all. Silver chloride was identified as a major contaminant by comparing AgCl calibration mass spectra with the spectra obtained from the clean and contaminated capacitors. Author (NSA)

N74-26743# Sandia Labs., Albuquerque, N.Mex.
MODULARIZATION OF ELECTRICAL CONNECTORS
D. W. MacAvoy (Bendix Corp., Sidney, N.Y.) and D. W. Hoffman 1973 19 p Presented at Connector Symp., Cherry Hill, N.J., Oct. 1973 Sponsored by AEC
(SLA-73-5637; Conf-731035-1) Avail: NTIS HC $3.00

A modular connector and ancillary components were designed to meet demanding electrical and mechanical requirements for use in detecting and analyzing seismic and acoustic variations in the environment in which they were placed. The modular connector provides the make-and-break connection for an electric circuit and the housing and wiring for an electronic circuit mounted on a printed circuit. The termination connectors have fixed-power contacts with solder cups and removable coaxial contacts with coaxial wire leads. NSA

N74-26744# Siemens A.G., Munich (West Germany).
FEASIBILITY STUDY OF THE POWER STAGE OF A MARITIME SATELLITE Final Report
G. Palz and E. Schmid 14 Dec. 1973 71 p refs
(Contract ESTEC-SC/9/73/HQ)
(ESRO-CR(P)-403) Avail: NTIS HC $6.75

Several cases of traveling wave tubes (TWT) and electric power conditioners (EPC) were calculated in order to find the optimum solution for the power stage of a maritime satellite. Different methods for efficiency enhancement taking into account linearity requirements, weight of EPC, and total power state were considered and the possible improvement of backoff-operation was investigated by measurements on an existing UHF-power TWT with an existing phase compensation network. Two feasible TWT versions, both using a depressed two stage collector and phase pre-distortion network, are proposed. The first version is designed for a saturation power of 120 W producing linear output power of 50 W. The second version is designed for a linear output power of 80 W but cannot be operated up to saturation without exceeding the variable dc power of 270 W. In order to achieve the required reliability, two independent power stages in standby redundancy were used. Author (ESRO)

N74-26745# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
APPLICABILITY INVESTIGATION OF STANDARD GATES [ONDERZOEK NAAR DE TOEPASBAARHEID VAN STANDARD GATES]
C. Vader Jan. 1973 56 p refs In DUTCH
(SL-293) Avail: NTIS HC $6.00

The properties and possible applications of Oberman Standard Gates were investigated. It is shown, that for complex switching functions, the standard gate version is more intricate than the integrated version. The many leads necessary for the standard gate circuit also make it more difficult to process than the integrated circuit. Author (ESRO)

N74-26746# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
BINARY-ADDRESSABLE SCAN CONVERSION STORAGE TUBE Quarterly Report, 15 Jul. - 14 Oct. 1973
Haden J. Bourg Mar. 1974 26 p
(Contract DAAB07-72-C-0052)
(AD-776989; ECOM-0052-8-72; QR-8) Avail: NTIS CSCL 09/1

The objective of the contract is to conduct a research and development program leading to the fabrication, testing, and delivery of a binary-addressable scan-conversion storage tube. The tube is to be capable of simultaneous write and non-destructive read operation at video frequencies up to 10 megahertz. The effort during this quarter consisted of acquiring the substrates for the digitizer plates and target. Demountable testing of the flood gun section of the device has resulted in a set of operational parameters for reasonable collimation of the flood beam. Two of the electrode masks have been fabricated, and preparations have been completed for making the remaining four. Investigations into the fabrication technique for the target were completed. Under present program restraints, laser drilling must be used for fabrication of the target as well as the digitizer plates. Development of a fast address circuit for the device has also been terminated, since it was severely hampering other necessary program efforts. The device will be addressed with the circuit used for driving the Phase I device. Author (GRA)

N74-26747# Army Electronics Command, Fort Monmouth, N.J.
STUDY OF TRANSIENT RADIATION EFFECTS ON A MONOLITHIC INTEGRATED OPERATIONAL AMPLIFIER CIRCUIT
H. Schauer and P. Hudson Mar. 1974 32 p
(DA Proj. 1S7-62705-A-440)
(AD-776913; ECOM-4206) Avail: NTIS CSCL 09/1

The micro Amp 776 micropower operational amplifier was irradiated in Cobalt-60, linear accelerator and fast burst reactor environments. The test procedures used, the test results obtained, and an analysis of the radiation induced failures are presented. Offset voltage increased 25% at 5600 rads (Si) Co60 exposure and up to 400% at 1 x 10 to the 5th power rads (Si) linac exposure. Open loop gain was degraded up to 70% at 6 x 10

to the 4th power rads (Si). Offset voltage approximately doubled at 4 x 10 to the 11th power n/cm (E > or = 10 keV), which is more significant at lower set currents where offset voltages are initially higher. Open loop gain decreased by up to 80% at 5 x 10 to the 11th power n/sq cm, largely due to decreased transistor current gain and partly due to a 30% reduction in quiescent current. Author (GRA)

N74-26748# Army Foreign Science and Technology Center, Charlottesville, Va.
APPLICATION AND DESIGN OF DELAY SYSTEMS WITH CELLS ARRANGED IN TWO TIERS IN FREQUENCY SCAN ANTENNAS
M. G. Kuznetsov 7 Dec. 1973 41 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Moscow), no. 159, 1964 p 51-85
(AD-776513; FSTC-HT-23-1724-72) Avail: NTIS CSCL 09/5

The report describes the use of delay systems with cells arranged in two tiers in order to reduce losses in frequency scan antennas. Characteristic features of the systems are presented in detail in the report. GRA

N74-26749# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
COUPLED PIEZOELECTRIC VIBRATIONS OF QUARTZ PLATES
R. D. Mindlin Nov. 1973 22 p refs
(Contract N00014-67-A-0108-0027; NR Proj. 064-388)
(AD-775653; TR-26) Avail: NTIS CSCL 09/1

The contributions of coupling with the electric field and mass of electrode coatings are taken into account in solutions of equations governing coupled thickness-shear, flexure and face-shear vibrational modes in rotated-Y-cut quartz plates. Author (GRA)

N74-26750# Physical Electronics Labs., Menlo Park, Calif.
BROADBAND FERRITE LIMITERS Final Annual Report, Jul. 1972 - Oct. 1973
Scott S. Elliott, Sidney T. K. Nieh, and O. Wetterhorn Feb. 1974 104 p refs
(Contract DAAB07-72-C-0305)
(AD-775846; ECOM-0305-F-72; FAR-1) Avail: NTIS CSCL 09/1

The objective of the program was to develop and demonstrate broadband frequency selective ferrite limiters in the frequency range from 4.4 - 5.0 GHz, from 8 - 10 GHz and from 10-12 GHz. The design goals are to achieve a relatively low threshold power with a low level insertion of 1.0 db. The device will operate in the subsidiary-resonance mode using a periodic array of dielectric resonators. Prototype devices were built and tested, and the results are discussed. Author (GRA)

N74-26751# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ON RESOLVING ANGLE AMBIGUITIES OF N-CHANNEL INTERFEROMETER SYSTEMS FOR ARBITRARY ANTENNA ARRANGEMENTS IN A PLANE
James E. Hanson Oct. 1973 159 p
(Contract N00017-72-C-4401)
(AD-776335; APL-TG-1224) Avail: NTIS CSCL 09/5

The concept of array ambiguity plot is introduced, and it is shown that there are exactly five distinct topological cases for antennas arranged in a plane. Some examples are given, including all regular polygon arrangements. The remainder of the paper is concentrated on those antenna arrays having a two-dimensional lattice point topology for their array ambiguity plots, as they appear to have the most forgiving tolerance requirements. Angle processing implementation and measurement tolerances for ambiguity resolution are discussed. It is shown that, for a given tolerance and region within which antennas are to be located, the ambiguities of the plot move away exponentially with number of antennas if they are placed judiciously. It is therefore possible to obtain the advantages of wide baseline systems which are ambiguity-free with just a few antennas. The one-dimensional antenna array situation is treated, it being a special case of the theory. Author (GRA)

N74-26752# Naval Research Lab., Washington, D.C.
FFT DOPPLER FILTER PERFORMANCE COMPUTATIONS
J. K. Hsiao Mar. 1974 63 p refs
(AD-777722; NRL-MR-2744) Avail: NTIS CSCL 09/5

The fundamental theory of a FFT Doppler filter is briefly reviewed. Computer programs to plot the responses and improvement factors of these filters are presented in this report. A wide choice of weighting functions are included in these programs. A number of examples are computed and presented. Author (GRA)

N74-26753# Harry Diamond Labs., Washington, D.C.
PERMITTIVITY AND PERMEABILITY OF METAL OXIDE VARISTORS: THEIR EFFECT ON APPLICATIONS OF MOV'S TO SURGE SUPPRESSION CONNECTORS
John Beilfuss Dec. 1973 18 p refs
(DNA Proj. NWET-R99QAXE; HDL Proj. E043E2)
(AD-777527; HDL-TM-73-37) Avail: NTIS CSCL 09/1

The feasibility of using metal oxide varistors in electromagnetic pulse surge suppression connectors is currently being investigated. Toward that end, dielectric constants of four varistor types are found to be between 700 and 1000 at 1 kHz, decreasing by approximately 25 percent at 65 MHz. Dielectric constants as a function of temperature (-65 to 165F) are also reported. When used as the suppression element in a type N coaxial connector, the large capacitance will limit transmission bandwidth to frequencies below 10 MHz. Author (GRA)

N74-26754# Sperry Rand Research Center, Sudbury, Mass.
TRAPATT AMPLIFIER FOR PHASED ARRAYS Final Report, 1 Feb. - 31 Mar. 1973
M. I. Grace, C. N. Potter, H. Kroger, and H. J. Pratt Feb. 1974 85 p refs
(Contract F30602-72-C-0202; AF Proj. 5573)
(AD-777602; SCRC-CR-73-3; RADC-TR-73-409) Avail: NTIS CSCL 09/5

The report describes the design and development of a wideband TRAPATT amplifier in a microstrip configuration, and is also concerned with the progress being made on the development of CW devices in a ring geometry. Particular emphasis is placed on describing surface degradation effects observed in large periphery devices and the approaches used toward solving these difficulties. An amplifier broadbanding technique based on a lumped element technique is described and preliminary experimental results are presented. A section describing the use of small area diodes as a means of lowering input power thresholds for a TRAPATT amplifier is included. Improvements in amplifier efficiency through the use of a new bias network which permits second harmonic tuning is also described. Finally, a summary of a generalized TRAPATT amplifier design technique is presented. Author (GRA)

N74-26755# Boeing Co., Seattle, Wash.
A STUDY OF ELECTRONICS RADIATION HARDNESS ASSURANCE TECHNIQUES. VOLUME 2, PART 3: ELECTRICAL SCREENING FOR SECOND BREAKDOWN Final Report, 31 Jul. 1970 - 16 Jul. 1973
I. Arimura, Allan H. Johnston, L. L. Sivo, and D. W. Egelkrout Jan. 1974 128 p refs
(Contract F29601-71-C-0001; AF Proj. 8809)
(AD-777187; AFWL-TR-73-134-Vol-2-Pt-3) Avail: NTIS CSCL 09/3

The objectives of the second breakdown (SB) program were to determine analytical dependences for IC and power transistor SB susceptibility in neutron and gamma ray environments and to investigate means of prediction of SB in a radiation environment through nondestructive screening methods. GRA

N74-26756# Battelle Columbus Labs., Long Beach, Calif. Research Facility.
ELECTRICAL AND MECHANICAL EVALUATION OF RUWS (REMOTE UNMANNED WORK SYSTEM) PROTOTYPE CABLES, VOLUME 1 Final Report, 20 Feb. - 31 Oct. 1973
F. G. White, R. C. Burgener, G. L. Thomas, P. T. Gibson, and H. A. Cress 31 Oct. 1973 148 p
(Contract N00123-73-C-1277)
(AD-777688) Avail: NTIS CSCL 09/1

Two prototype electro-mechanical cables were evaluated electrically and mechanically to determine the suitability of the design and of the manufacturing process to the requirements of

the Navy's Remote Unmanned Work System, RUWS. Electrical measurements included characteristic impedance, attenuation, dc resistance, dielectric resistance, insulation resistance and corona onset and extinction voltages. Mechanical experiments measured torque balance, elongation, tensile strength and fatigue life under simulated operational conditions. The prototype cables included a coaxial conductor core surrounded by two contrahelical strength member layers which were constructed of KEVLAR-49, a high-strength, high modulus organic fiber material developed by du Pont. Its advantage, for the RUWS application, is the reduction of cable weight without sacrifice of cable strength. (Modified author abstract) GRA

N74-26757# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 Nov. 1973 - 31 Jan. 1974
Melvin A. Herlin and Alan L. McWhorter 15 Feb. 1974 22 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-777154; ESD-TR-74-37) Avail: NTIS CSCL 09/1

The Quarterly Technical Summary covers the period 1 November 1973 through 31 January 1974. It consolidates the reports of Division 2 (Data Systems) and Division 8 (Solid State) on the Advanced Electronic Technology Program. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-26758 Illinois Univ., Urbana.
COMPUTER-AIDED DESIGN OF MICROWAVE CIRCUITS Ph.D. Thesis
Edgar Sanchez-Sinencio 1973 68 p
Avail: Univ. Microfilms Order No. 74-12171

A computer program for the analysis and design of distributed-lumped circuits, including microwave integrated circuits was examined. It is capable of frequency domain analysis, optimization of transducer power gain, reflection coefficient, and/or noise figure. Also, the program can compute the return difference with respect to any admittance parameter so that the stability of the circuit can be determined by the Nyquist criterion. The program handles complex impedances, resistors, capacitors, inductors, transmission lines, independent current sources and grounded voltage sources, voltage controlled current sources, and multiport elements, such as, transistors and circulators, described by their scattering or admittance parameters. It contains a free-format input. The implementation is based on the indefinite admittance matrix, sparse matrices, adjoint networks, the Fletcher-Powell or Fletcher minimization algorithm, and Bode's feedback theory. Some examples illustrating the use of the program and the design techniques are included. Dissert. Abstr.

N74-26759*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
CONTROL OF FINITE-STATE, FINITE MEMORY STOCHASTIC SYSTEMS Ph.D. Thesis
Nils R. Sandell, Jr. May 1974 198 p refs
(Grants NGL-22-009-124; AF-AFOSR-2273-72; NSF GK-25781; NSF GK-41647; MIT OSP Proj. 81641; MIT OSP Proj. 73935; MIT OSP Proj. 76265)
(NASA-CR-138674; ESL-R-545) Avail: NTIS HC $13.00 CSCL 09D

A generalized problem of stochastic control is discussed in which multiple controllers with different data bases are present. The vehicle for the investigation is the finite state, finite memory (FSFM) stochastic control problem. Optimality conditions are obtained by deriving an equivalent deterministic optimal control problem. A FSFM minimum principle is obtained via the equivalent deterministic problem. The minimum principle suggests the development of a numerical optimization algorithm, the min-H algorithm. The relationship between the sufficiency of the minimum principle and the informational properties of the problem are investigated. A problem of hypothesis testing with 1-bit memory is investigated to illustrate the application of control theoretic techniques to information processing problems. Author

N74-26760*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIODE QUAD TRANSDUCER AND DISCRIMINATOR CIRCUIT Patent Application
John Dimeff and Dean R. Harrison, inventors (to NASA) Issued 22 Apr. 1974 20 p
(NASA-Case-ARC-10364-3; US-Patent-Appl-SN-462844) Avail: NTIS HC $4.00 CSCL 09C

An electrical measuring apparatus consisting of a transducer and discriminator circuits using a four terminal circulating diode bridge is discussed. The bridge is used in combination with various impedance elements to produce an output signal which is proportional to a relationship between at least two of the impedance elements. Advantages of the circuit over previous similar devices are described. Diagrams of the circuit are provided. NASA

N74-26761# Ruhr Univ., Bochum (West Germany). Abteilung Maschinenbau.
APPLICATION OF THREE-LEVEL PSEUDORANDON SIGNALS FOR THE IDENTIFICATION OF NONLINEAR CONTROL SYSTEMS Ph.D. Thesis [ANWENDUNG VON DREIWERTIGEN PSEUDOZUFAELLIGEN SIGNALEN ZUR IDENTIFIKATION NICHTLINEARER REGELUNGS-SYSTEME]
Roman Krempl Dec. 1973 166 p refs In GERMAN
(RUB-LMRT-1) Avail: NTIS HC $11.50

Nonlinear systems were investigated using trivalent pseudo-random signals. The Hammerstein and simplified Wiener models are discussed. Mathematical fundamentals of pseudorandom signals were laid down and a method for the evaluation of the characteristics of nonlinear systems is discussed. The method was extended for the case in which characteristic curve possesses hysteresis properties. The equipment developed for testing the theory is detailed. ESRO

N74-26762# Ruhr Univ., Bochum (West Germany). Abteilung Maschinenbau.
CONTRIBUTION TO THE THEORY OF SEQUENTIAL SWITCHES (TRANSDUCTION METHOD FOR THE SYNTHESIS OF ASYNCHRONOUS AUTOMATS) Ph.D. Thesis - Vienna Univ. [EIN BEITRAG ZUR THEORIE SEQUENTIELLER SCHALTUNGEN (DAS TRANSDUKTIONS-VERFAHREN ZUR SYNTHESE ASYNCHRONER AUTOMATEN)]
Peter Vingron Jan. 1974 133 p refs In GERMAN
(RUB-LMRT-2) Avail: NTIS HC $9.75

Fundamentals of the synthesis of switching circuits are given along with algebraic computation method for the synthesis of asynchronous circuits. Particular attention was given to storage functions. From these functions a procedure for the synthesis of two dimensional circuits was worked out. The theorem for two dimensional circuits was extended for the multidimensional case. ESRO

N74-26763# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
THRESHOLD LOGIC [DREMPELLOGICA]
C. Vader and J. W. M. Wasser May 1973 71 p refs In DUTCH
(SL-299) Avail: NTIS HC $6.75

The theory is discussed of presently available threshold logic circuits, and an analysis of threshold functions is presented. An operational threshold gate adding circuit in TTL technology is described, and the difficulty of improving logic in complex circuits is emphasized. It is shown that it is possible to realize integrated circuits with threshold adjustment. Author (ESRO)

N74-26764# Network Analysis Corp., Glen Cove, N.Y.
THE PRACTICAL IMPACT OF RECENT COMPUTER ADVANCES ON THE ANALYSIS AND DESIGN OF LARGE SCALE NETWORKS Semiannual Technical Report
Howard Frank Dec. 1973 524 p refs
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-777738; SATR-2B) Avail: NTIS CSCL 09/2

New research results on the following major questions are

reported: ARPANET growth, Impact of Satellite channels on packet network cost and performance, terminal oriented network cost and performance, packet switched network design, routing in packet networks, large network computations, broadcast packet system considerations, routing and acknowledgement schemes for broadcast systems, spread spectrum considerations for packet systems, broadcast packet techniques on cable. Author (GRA)

N74-26765# Martin Marietta Aerospace, Orlando, Fla. Materials Engineering Labs.
RELIABILITY STUDY OF POLYIMIDE/GLASS MULTILAYER BOARDS Final Technical Report, Mar. 1972 - Jun. 1973
Walter S. Rigling Jan. 1974 64 p
(Contract F30602-72-C-0242; AF Proj. 5519)
(AD-777194; OR-12665; RADC-TR-73-400) Avail: NTIS CSCL 09/5

A program was undertaken to thoroughly characterize polyimide resin thin laminate prepregs and completed multilayer boards while subjecting them to comprehensive electrical, mechanical, and environmental tests far exceeding the capabilities of other systems. The polyimide resin systems performed reliably during the tests with no evidence of degradation. It can be concluded from this program that polyimide resin, fiberglass-reinforced board materials are available that can produce multilayer printed wiring boards capable of continuous operation at over 150C and thermal cycling up to 200C without plated-through failure or degradation of electrical characteristics. These materials require no modification to existing laminating equipment or facilities. (Modified author abstract) GRA

N74-26766# Boeing Co., Seattle, Wash.
A STUDY OF ELECTRONICS RADIATION HARDNESS ASSURANCE TECHNIQUES. VOLUME 2, PART 2: ELECTRICAL SCREENING FOR IONIZING RADIATION RATE AND TOTAL DOSE EFFECTS Final Report, 31 Jul. 1970 - 16 Jul. 1973
I. Arimura and Allan H. Johnston Jan. 1974 148 p refs 3 Vol.
(Contract F29601-71-C-0001; AF Proj. 8809)
(AD-777186; AFWL-TR-73-134-Vol-2-Pt-2) Avail: NTIS CSCL 09/3

The electrical screening approach examined correlations between certain initial electrical parameters and the radiation sensitivities of the devices. The correlation parameters were selected on the basis of physical reasoning and the radiation sensitivities were defined differently for the various radiation environments. Ionizing radiation rate hardness assurance is treated with subdivision determined again by the various classes of devices. MTBF results are also discussed for parts subjected to ionizing rate tests. Total dose hardness assurance is discussed for the low-power transistors and for the op amp separately. Low dose screening is included in this section although it differs slightly from the normal techniques of electrical screening. GRA

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-26767* National Aeronautics and Space Administration. Pasadena Office, Calif.
DISPENSING TARGETS FOR ION BEAM PARTICLE GENERATORS Patent
Charles G. Miller, inventor (to NASA) (JPL) Issued 11 Jun. 1974 6 p Filed 29 Jun. 1972 Supersedes N73-29138 (11 - 20, p 2382) Sponsored by NASA
(NASA-Case-NPO-13112-1; US-Patent-3,816,785;
US-Patent-Appl-SN-267572; US-Patent-Class-313-61S;
US-Patent-Class-250-499) Avail: US Patent Office CSCL 14B

A target for dispensing high energy protons or neutrons or ionized atoms or ionized molecules is provided which comprises a container for the target gas, which is at atmospheric or higher pressure. The container material can release the target gas in the spot where the container is heated above a predetermined temperature by the impact of an ion beam where protons or neutrons are desired, or by electrons where ionized atoms or molecules are desired. On the outside of the container, except for the region where the beam is to impact, there is deposited a layer of a metal which is imperious to gaseous diffusion. A further protective coating of a material is placed over the layer of metal, except at the region of the ion impact area in order to adsorb any unreacted gas in the vacuum in which the target is placed, to thereby prevent reduction of the high vacuum, as well as contamination of the interior of the vacuum chamber.
Official Gazette of the U.S. Patent Office

N74-26768 Utah State Univ., Logan.
DYNAMIC RESPONSE OF THE LANDING MAT TO AIRCRAFT LANDING Ph.D. Thesis
Kambiz Daftarian 1973 103 p
Avail: Univ. Microfilms Order No. 74-13210

A method is presented for obtaining the dynamic response of landing mats to aircraft landing for the purpose of preventing the damage which occurs when a C-54 aircraft lands on temporary runways constructed of AM-2 landing mat panels. The model used consisted of discrete rigid masses. Springs and dashpots were used to simulate the joints and the matsubgrade interface. Newtonian and Lagrangian mechanics were two independent ways to derive the equations governing the motion of the system. A computer program was written and numerical methods were used to determine the results of non-linear coupled differential equations that govern the motion of the system. The parameters used represent the constants associated with AM-2 landing mats which are used for C-5A Galaxy aircraft. The approximate values for parameters were found by some simple static and dynamic tests. The factors found to influence the stability of landing mats are described. Dissert. Abstr.

N74-26769*# Ohio State Univ. Research Foundation, Columbus.
GEOMETRIC ADJUSTMENT OF THE SOUTH AMERICAN SATELLITE DENSIFICATION (PC-1000) NETWORK
Ivan I. Mueller and M. Kumar Feb. 1973 29 p refs
(Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-138627; Rept-196) Avail: NTIS HC $4.50 CSCL 22D

Reduced normal equations were computed from observation data and combined with reduced normal equations of other satellite networks to provide station coordinates from a single least square adjustment. Terrestrial data, which include base-lines, heights, and survey coordinates, provide the necessary relative position constraints between collocated stations of two satellite networks. Survey information regarding the observation stations is summarized, and constraints used in the solution are given. Geoidal undulations are computed by using the formula and constants shown. Author

N74-26770*# Rensselaer Polytechnic Inst., Troy, N.Y.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Progress Report, 1 Jul. - 31 Dec. 1973
D. K. Frederick, P. K. Lashmet, W. R. Moyer, G. N. Sandor, C. N. Shen, E. J. Smith, and S. W. Yerazunis 31 Dec. 1973 116 p refs
(Grant NGL-33-018-091)
(NASA-CR-138670; RPI-TR-MP-39) Avail: NTIS HC $9.00 CSCL 13F

The following tasks related to the design, construction, and evaluation of a mobile planetary vehicle for unmanned exploration of Mars are discussed: (1) design and construction of a 0.5 scale dynamic vehicle; (2) mathematical modeling of vehicle dynamics; (3) experimental 0.4 scale vehicle dynamics measurements and interpretation; (4) vehicle electro-mechanical control systems; (5) remote control systems; (6) collapsibility and deployment concepts and hardware; (7) design, construction and evaluation of a wheel with increased lateral stiffness, (8) system design optimization; (9) design of an on-board computer; (10) design and construction of a laser range finder; (11)

measurement of reflectivity of terrain surfaces; (12) obstacle perception by edge detection; (13) terrain modeling based on gradients; (14) laser scan systems; (15) path selection system simulation and evaluation; (16) gas chromatograph system concepts; (17) experimental chromatograph separation measurements and chromatograph model improvement and evaluation.
Author

N74-26771*# Ohio State Univ. Research Foundation, Columbus.
FREE GEOMETRIC ADJUSTMENT OF THE SECOR EQUATORIAL NETWORK (SOLUTION SECOR-27)
Ivan I. Mueller, M. Kumar, and Tomas Soler Feb. 1973 50 p refs
(Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-138597; Rept-195) Avail: NTIS HC $5.50 CSCL 22D

The basic purpose of this experiment is to compute reduced normal equations from the observational data of the SECOR Equatorial Network obtained from DMA/Topographic Center, D/Geodesy, Geosciences Div. Washington, D.C. These reduced normal equations are to be combined with reduced normal equations of other satellite networks of the National Geodetic Satellite Program to provide station coordinates from a single least square adjustment. An individual SECOR solution was also obtained and is presented in this report, using direction constraints computed from BC-4 optical data from stations collocated with SECOR stations. Due to the critical configuration present in the range observations, weighted height constraints were also applied in order to break the near coplanarity of the observing stations.
Author

N74-26772*# Rensselaer Polytechnic Inst., Troy, N.Y.
PATH SELECTION SYSTEM DEVELOPMENT AND EVALUATION FOR A MARTIAN ROVING VEHICLE
Richard S. Campbell and Robert R. Simonds May 1974 93 p refs
(Grant NGL-33-018-091)
(NASA-CR-138588; RPI-TR-MP-42) Avail: NTIS HC $7.75 CSCL 14B

A path selection system evaluation test procedure has been developed to enhance the analysis capability of an existing digital computer simulation package. The procedure investigates the obstacle avoidance ability of a path selection system on a sequence of test terrains with and without random effects. Using the standard test procedure a proposed mid-range sensor system has been evaluated and recommendations directed at improving the performance of the system have been made. In addition, the initial development and evaluation of a short range sensor system has been undertaken.
Author

N74-26773*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
FREE GEOMETRIC ADJUSTMENT OF THE DOC/DOD COOPERATIVE WORLDWIDE GEODETIC SATELLITE (BC-4) NETWORK
James P. Reilly, M. Kumar, Ivan I. Mueller, and N. Saxena 1973 182 p refs
(Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-138598; Rept-193) Avail: NTIS HC $12.25 CSCL 22D

The application of observations from the ANNA satellite to solve geodetic problems is discussed. The establishment of a worldwide network of optical observing stations by the National Geodetic Survey is reported. The geodetic network is composed of 49 observing stations, more or less evenly distributed throughout the world. A method for using correlated satellite observations for the accurate recovery of ground station positions and applying the result to the adjustment of the National Geodetic Survey worldwide network was developed.
Author

N74-26774# Joint Publications Research Service, Arlington, Va.
THE PROSPECTS FOR MHD POWER PLANTS IN POWER ENGINEERING
V. A. Kirillin, L. A. Melentyev, and A. Ye. Sheyndlin 31 May 1974 19 p Transl. into ENGLISH of "O Perspektivakh MGD Elecktrostantsiy v Energetike" Moscow, 1974 p 1-21
(JPRS-62139) Avail: NTIS HC $4.00

A brief review is presented of the basic results of the first phase of development of the U-25 installation.
Author

N74-26775# Joint Publications Research Service, Arlington, Va.
EXPERIENCE FROM THE FIRST STAGE OF DEVELOPMENT OF THE U-25 INSTALLATION
A. Ye. Sheyndlin, A. V. Nedospasov, S. A. Pashkov, D. S. Pinkhasik, S. I. Pishchikov, V. S. Sidorov, G. P. Telegin, Ye. M. Shelkov, and V. Ya. Shumyatskiy 31 May 1974 21 p Transl. into ENGLISH of "Opyt Pervogo Etapa Osvoyeniya Ustanovki U-25" Moscow, 1973
(JPRS-62129) Avail: NTIS HC $4.25

A description is given of the U-25 installation which is an experimental combined power plant with an open-cycle MHD generator.
Author

N74-26776# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
A MARS ROVER CONCEPT FOR FUTURE LANDER MISSIONS
D. E. Koelle, W. Kokott, and W. Schultze 1974 16 p Presented at the Intern. Symp. on Planetary Exploration, Heidelberg, 15-16 Feb. 1974
(DGLR-Paper-74-007) Avail: NTIS HC $4.00

The design concepts and interface requirements for a Mars rover are presented. Design restrictions are discussed and five alternative vehicle types are suggested. Design fundamentals are reviewed. Methods for stowage and deployment are dealt with. The subsystems are discussed with regard to mobility constraints, sensors, traction turns, hazard detection and avoidance, chassis wheels and drive, power system, thermal systems, telecommunications, and data handling. Some scientific applications and operations are outlined with regard to payload baseline and data budget (computer and storage), telecommunication link, and optimization. Mission optimization is summarized with regard to launch/arrival windows, seasonal effects, landing site possibilities, and operations.
ESRO

N74-26777# Harry Diamond Labs., Washington, D.C.
GAS GUN LAUNCH OF FREE FLYING THIN PLATE
James C. Blackburn and Phillip S. Brody Aug. 1973 31 p refs
(DA Proj. 1T0-61101-A-91A; HDL Proj. ILR-80)
(AD-775801; HDL-TR-1642) Avail: NTIS CSCL 14/2

The report describes a method used for propelling a thin disk flyer plate against a target to produce pulse-form shocks. A projectile is accelerated in a rupturing-diaphragm type gas gun, strikes a fixed metal plate, and is stopped. The impact-generated shock wave travels through the metal plate and spalls off a thin aluminum disk attached to its opposite surface. The method of bonding the thin disk to the plate is critical for good shock transfer low-viscosity eastman 910 adhesive is most satisfactory. Disks 0.8 mm or 0.3 mm thick and 8.5 cm in diameter are propelled at velocities up to 280 m/sec, impacting a target flat within 0.1 mm. The expected flyer-to-projectile velocity ratio and wave profiles are computed with the puff 66 code. The predicted velocity ratio is 0.78 and the experimental value is 0.61 this is a reasonable discrepancy considering the simplifying assumptions. In relatively low-velocity thick flyers this method appears comparable to the best available.
Author (GRA)

N74-26778# Army Electronics Command, Fort Monmouth, N.J.
PULSER FOR EMP SIMULATION
William H. Wright, Jr. Feb. 1974 73 p refs
(DA Proj. 1S7-62705-AH-94)
(AD-776344; ECOM-4198) Avail: NTIS CSCL 14/2

The project was undertaken to provide a pulser capable of driving a low-impedance array of antennas with a high-peak-power, short risetime pulse to simulate the electrical interference effects of an electromagnetic pulse (EMP). The final pulser produced a 100 kilovolt (kV), 72 kiloamperes (kA) output pulse with a 6 nanosecond (ns) voltage risetime and 42 ns current risetime through a single output switch. Additional experiments showed how multiple output switches could reduce the current risetime to 14 ns with a 9 ns jitter. The output switch was a water-or-air-filled spark gap, and operation in both modes is described. The report also includes design information on a

simple and reliable 100 kV d.c. switch, a low-impedance high power dummy load, and voltage and current measuring devices for viewing fast transients. (Modified author abstract) GRA

N74-26779# Army Edgewood Arsenal, Md.
VELOCITIES OF FALLING DROPLETS ONE MILLIMETER IN DIAMETER Final Technical Report, May 1971 - Jun. 1972
John B. Samuel, Elwin C. Penski, and Harry A. Brown, Jr. Mar. 1974 15 p refs
(DA Proj. 1W0-62116-AD-10; DA Proj. 1T0-61102-B-71A)
(AD-776953; EC-TR-73071) Avail: NTIS CSCL 14/2

Experimental apparatus and techniques described measure the rate of fall of liquid droplets. The velocity of freely falling and accelerating 1.0 mm (approx.) diameter drops of nitrobenzene and chemical agent GB were studied at Reynolds numbers below 230 under ambient atmospheric conditions. The experimentally-determined velocities were compared with those calculated using the drag coefficients of water droplets moving at terminal velocity. Author (GRA)

N74-26780# Aerospace Corp., San Bernardino, Calif. Technology Div.
NUMERICAL ANALYSIS OF A TRANSMISSION LINE EMP SIMULATOR Technical Report, May - Dec. 1973
Keith M. SooHoo 18 Jan. 1974 34 p refs
(AD-777573; TR-0074(4124)-4; SAMSO-TR-74-72) Avail: NTIS CSCL 20/14

A theoretical model is defined for an electromagnetic pulse (EMP) simulator for testing EMP effects on high altitude satellites. The simulator is composed of three flat-plate transmission line sections. The first and third sections are tapered to accommodate, respectively, a generator and a terminating resistor. This problem is analyzed in the frequency domain over those frequency components which are known to contribute most significantly to a typical EMP waveform. The analysis uses a numerical technique to solve the basic problem of an unknown current distribution on a curved, tapered strip, excited by a known electric field. The unknown current is solved by the method of moments, using triangular basis functions. To check the computer program, input impedances are computed for the triangular dipole. It is shown that these solutions compare quite favorably with experimental results. Variations in the solutions are also demonstrated for these same cases when edge singularities are not taken into account in the analysis. (Modified author abstract) GRA

N74-26781# Air Force Weapons Lab., Kirtland AFB, N.Mex.
EVALUATION OF RUNWAY SKID-RESISTANCE CHARACTERISTICS AT ELLSWORTH AFB, SOUTH DAKOTA Final Report, Oct. 1972 - Jun. 1973
George D. Ballentine and Phil V. Compton Mar. 1974 50 p
(AF Proj. 683M)
(AD-776761; AFWL-TR-74-8) Avail: NTIS CSCL 01/5

Data gathered during the Air Force Weapons Laboratory standard skid-resistance test conducted at Ellsworth AFB, South Dakota, on 21 October 1972 are analyzed. The test results indicate the runway surface had only fair skid-resistance properties and decidedly poor drainage characteristics. The report recommends an overlay be constructed on the runway to correct the drainage problem, followed by a porous friction surface to improve skid-resistance properties. Author (GRA)

N74-26782# Air Force Weapons Lab., Kirtland AFB, N.Mex.
EVALUATION OF RUNWAY SKID-RESISTANCE CHARACTERISTIC AT K. I. SAWYER AFB, MICHIGAN Final Report, 1 Oct. 1972 - 30 Jun. 1973
George D. Ballentine and Phil V. Compton Mar. 1974 56 p
(AD-777188; AFWL-TR-74-25) Avail: NTIS CSCL 01/5

Data gathered during the Air Force Weapons Laboratory standard skid-resistance test conducted at K. I. Sawyer AFB, Michigan, on 14 October 1972 are analyzed. The test results indicate the runway surface had good to fair skid-resistance properties, and no immediate corrective action was indicated at the time of the test. Because of low friction readings on the portland cement concrete portion of the runway, retesting after 1-1/2 to 2 years is recommended. Author (GRA)

N74-26783# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SET-UP FOR CALIBRATING AIRBORNE INSTRUMENTS AND LABORATORY SIMULATION OF FLOW AROUND MODELS BY DILUTED PLASMA
E. N. Yevlanov, V. B. Leonas, and S. V. Umanskii 26 Mar. 1974 18 p refs Transl. into ENGLISH from the book "Mezhplanetnaya Sreda i Fiz. Magnetosfery" USSR, 1972 p 202-209
(AD-777263; FTD-MT-24-420-74) Avail: NTIS CSCL 04/1

The problem of studying the ionosphere with the aid ISZ (artificial earth satellites) led to the need for the creation of set-ups to simulate the characteristic conditions of outer space, in particular, set-ups for the laboratory simulation of ISZ movement in ionospheric plasma. The article describes a set-up intended both for the laboratory calibration of airborne instruments used during study of the upper ionosphere and for studying the flow around small-scale models of ISZ by diluted ionized gas. GRA

N74-26881 Joint Publications Research Service, Arlington, Va.
THE 125TH ANNIVERSARY OF THE MAIN GEOPHYSICAL OBSERVATORY IM. A. I. VOYEYKOV
Ye. P. Borisenkov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 1-7 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3 1974 p 3-8 (For availability see N74-26880 16-13)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-26784 Ohio State Univ., Columbus.
THE LAMINAR BOUNDARY LAYER ON A FINITE ROTATING DISC Ph.D. Thesis
Richard James Bodonyi 1973 210 p
Avail: Univ. Microfilms Order No. 74-10917

The existence of a steady incompressible laminar boundary layer which begins at the end of a finite rotating disc is investigated. The disc placed in an otherwise unbounded rigidly rotating fluid is found to be limited by the value of the parameter alpha, the ratio of the disc's angular speed to that of the rigidly rotating fluid. The value depends on the structure of the similarity equations applicable at the center and edge of the disc. As a result of the analysis the critical value of alpha was found to be -0.6961; and futhermore, the solutions agreed well with the existing numerical results. Dissert. Abstr.

N74-26785 California Univ., Los Angeles.
STUDIES OF THERMAL CONVECTION IN HORIZONTAL AND INCLINED FLUID LAYERS Ph.D. Thesis
Richard Michael Clever 1973 155 p
Avail: Univ. Microfilms Order No. 74-11510

An analytical study has been made of the thermally driven convective motions that occur in horizontal and inclined fluid layers. Various flow regimes have been studied in an effort to understand the structure of thermal convection and its relation to the transport characteristics in buoyancy driven flows. In order to understand these phenomena the investigation focuses on three related problems: (1) a study of the convective motions in an internally heated high Prandtl number horizontal fluid layer; (2) a study of convection in a low to moderate Prandtl number horizontal fluid layer; and (3) a study of the two basic types of convective motions that admit nonconvective heat transfer from the hot to the cold boundary in an inclined, high Prandtl number fluid layer. Dissert. Abstr.

N74-26786 Oregon State Univ., Corvallis.
ANALYSIS OF HEAT TRANSFER, INCLUDING AXIAL CONDUCTION, FOR LAMINAR TUBE FLOW WITH ARBITRARY CIRCUMFERENTIAL WALL HEAT FLUX Ph.D. Thesis
Mohammed Faghri 1974 257 p
Avail: Univ. Microfilms Order No. 74-13411

The analysis of heat transfer in a tube with forced flow under conditions of an arbitrary variation of wall heat both axially and circumferentially was conducted. This total study is separated into two distinct problems which are presented separately. The first is the case of a Newtonian fluid in laminar flow with allowance made for the inclusion of axial heat conduction, viscous heat dissipation and heat generation. Secondly the problem of laminar flow of a non-Newtonian fluid is considered. Axial conduction is not included in this problem since it is likely negligible in those cases where non-Newtonian effects are significant. Heretofore, no general method has been available for obtaining solutions to these problems. Analytical results are given in such generality and completeness that many of the previously reported work in the heat transfer literature in laminar tube flow are limiting cases of the present work. Dissert. Abstr.

N74-26787 Maryland Univ., College Park.
IMPLICIT SOLUTIONS OF THE UNSTEADY NAVIER-STOKES EQUATION FOR LAMINAR FLOW THROUGH AND ORIFICE Ph.D. Thesis
David William Coder 1973 189 p
Avail: Univ. Microfilms Order No. 74-12818

A technique is presented for the numerical solution of the unsteady Navier-Stokes equation for laminar flow through a pipe orifice. The solution is accomplished through rearrangement of the Navier-Stokes equation and the continuity equation into a vorticity transport equation and a definition of vorticity equation. Two elliptical partial differential equations in the two variables of vorticity and stream function are obtained. Implicit finite difference forms of the equations are developed which are fourth order accurate in space and second order accurate in time. Grid networks were imposed on the flow field. Initial conditions were designated to be either (1) no flow in the case of the first time step, or (2) the results from the previous time step. Solutions were obtained from one time step to the next by iterating the vorticity transport and definition of vorticity equations together with the appropriate boundary conditions. Dissert. Abstr.

N74-26788 Stanford Univ., Calif.
EXPERIMENTS ON THE VELOCITY CHARACTERISTICS OF BURSTS' AND ON THE INTERACTIONS BETWEEN THE INNER AND OUTER REGIONS OF A TURBULENT BOUNDARY LAYER Ph.D. Thesis
George Richard Offen 1974 244 p
Avail: Univ. Microfilms Order No. 74-13668

The structure of a turbulent boundary layer on a smooth, flat plate was studied experimentally. Emphasis was placed on two flow features which appear to control the production and maintenance of the turbulence: (1) interactions between bursting low speed wall streaks and the flow field farther away from the wall, and (2) velocity characteristics of these bursts near the wall. In addition, the relationships between various burst detection schemes, which use only velocity data, and visual indications of bursting were also measured. The combined anemometer/dye experiments revealed that none of the proposed detection schemes correlates vary well with the visual indications of bursting or with any other scheme. Interpretations of the patterns observed during the flow visualization studies indicate that the structure of a turbulent boundary layer near the wall is the result of repetitive interactions between several more basic structures. A tentative model was proposed to explain the observed motions of these structures. Dissert. Abstr.

N74-26789 Stanford Univ., Calif.
A STUDY OF TWO HIGH REYNOLDS NUMBER STEADY FLOWS. 1: A ROTATING CIRCULAR CYLINDER IN A SIMPLE SHEAR. 2: BOUNDARY LAYERS WITH SEPARATED FLOWS Ph.D. Thesis
Charles Ayres Kossack 1974 130 p
Avail: Univ. Microfilms Order No. 74-13652

Studies concerning the high Reynolds number flow of an incompressible fluid were conducted. The two dimensional steady flow of a viscous fluid past a circular cylinder, placed symmetrically in a simple shear field was examined for both the stationary and freely rotating case by solving the Navier-Stokes equation for values of the Reynolds number in the range of .047 to 70. An asymptotic solution to the Navier-Stokes equations for steady, laminar flow at large Reynolds numbers is presented. The boundary layer contains both a forward and a reverse moving stream and remains attached to a solid surface even though subjected to an adverse pressure gradient. Dissert. Abstr.

N74-26790 Rensselaer Polytechnic Inst., Troy, N.Y.
SOLUTION OF CERTAIN PROBLEMS OF VISCOUS LAMINAR FLOW WITH APPLICATION IN ENGINEERING PROBLEMS Ph.D. Thesis
Theotokis A. Pafelias 1974 188 p
Avail: Univ. Microfilms Order No. 74-12792

The dynamic behavior of rotating journals in fluid film bearings, has been treated by many authors with eight linear elastic and damping coefficients. In the case of motion of the journal axis about a steady-running position, the coefficients relate the journal translational motion to the forces acting on it, along two perpendicular axes. In this work, the effect of the journal misalignment on these coefficients is examined. Furthermore, eight additional coefficients are introduced which relate the forces along the aforesaid axes to the rotational motion of the journal axis about them. Finally, sixteen coefficients are introduced, which relate the translational and rotational motion of the journal axis with respect to two perpendicular directions, to the moments about them. Dissert. Abstr.

N74-26791 Mississippi State Univ., State College.
INVESTIGATION OF NEAR FIELD WAKES BEHIND HIGH-LIFT WINGS Ph.D. Thesis
Rustom B. Damania 1973 144 p
Avail: Univ. Microfilms Order No. 74-13157

An experimental study was made of the partially rolled up vortex behind a high lift wing. Specifically, the velocity vector behind a STOL airplane was measured in flight. The data were obtained at two measurement planes behind the wing in the range of 3.0 to 0.85 for flapped and unflapped conditions. Wing surface pressure distribution and wake vorticity were also measured. Results are presented in the form of contour plots of vorticity and velocity components. Dissert. Abstr.

N74-26792# Lehigh Univ., Bethlehem, Pa. Dept. of Physics.
PARTICLE SAMPLING EFFICIENCIES FOR AN ASPIRATING BLUNT THICK-WALLED TUBE IN CALM AIR Final Report
David E. Kaslow and Raymond J. Emrich 15 May 1974 72 p refs
(Grant BM-GO-110235)
(TR-25) Avail: NTIS HC $6.75

Employing Levin's solution in the outer field, trajectories in actual flow fields have been calculated by computer to locate the critical trajectories separating the entering particles' paths from those paths where the particles hit the tube wall or escape. Sampling efficiencies are presented in terms of 3 variables--a dimensionless particle size coefficient, a dimensionless orifice size coefficient and the the tube orientation--for the no-wind case. Over most of the range of sampling conditions, the Stokes drag law can be used and dependence on the variable--particle Reynolds number--can be ignored. A procedure for achieving maximum efficiency in design of a sampler is proposed. Whether these results apply when typical room-sized eddies constitute the calm air environment is not known. Author

N74-26793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NORMALIZING PARAMETERS FOR THE CRITICAL FLOW RATE OF SIMPLE FLUIDS THROUGH NOZZLES
Robert C. Hendricks May 1974 11 p refs Presented at the 5th Intern. Cryog. Eng. Conf., Kyoto, 7-10 May 1974; sponsored by the Intern. Inst. of Refrig.
(NASA-TM-X-71545; E-7899) Avail: NTIS HC $3.00 CSCL 20D

The two-phase critical flow rate for the simple fluids of methane, nitrogen, oxygen, and argon were normalized using the parameter G* = the square root of (rho sub c x P sub c/Z sub c). The values of G* are given and the question of how to apply this procedure to normalize the critical flow rates of the quantum fluids para-hydrogen and helium was addressed. Experimental data for p-hydrogen, reduced pressures to 4.5 and reduced temperatures from 0.87, were analyzed. Author

N74-26794# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LASER INTERFEROMETER FOR STUDYING BOUNDARY LAYERS IN FLUIDS
A. G. Fedin and E. Ya. Blum Mar. 1973 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv. SSR, Ser. Fiz. Tekh. Nauk (Latvia SSR), no. 3, 1972 p 77-84
(NTC-74-11852; Rept-73-103) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A laser interferometer is described which uses the principles of the schlieren system. The questions involving the deciphering of the interference pattern are considered. A comparison of experimental results with the calculations shows that the device may be applied for studying thermal and diffusion boundary layers in fluids. The optical design of the equipment is described. The optical parameters of the investigation are analyzed. Mathematical models are developed to establish the relations for boundary layer conditions. Author

N74-26795*# Iowa State Univ. of Science and Technology, Ames.
NUMERICAL COMPUTATION OF TWO DIMENSIONAL VISCOUS BLUNT BODY FLOWS WITH AN IMPINGING SHOCK, PART 2 Final Report
T. L. Holst and John C. Tannehill Feb. 1974 59 p refs
(Grant NGR-16-002-038)
(NASA-CR-138594; ISU-ERI-AMES-74057-Pt-2) Avail: NTIS HC $6.00 CSCL 20D

Two-dimensional viscous blunt body flows with an impinging shock have been computed using a time-dependent finite-difference method which solves the complete set of Navier-Stokes equations for a compressible flow. For low Reynolds number flows, the entire flow field, including the bow shock and impinging shock, has been captured in the computation. For higher Reynolds number flows, the bow shock is treated as a discontinuity across which the Rankine-Hugoniot equations are applied, while the boundary layer and interaction regions are captured as before. Using this latter shock-fitting approach, a Type III shock interaction flow field has been computed with flow conditions corresponding to the space shuttle orbiter freestream conditions at 61 km (200,000 ft). Author

N74-26796*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.
FLUID DYNAMIC STUDIES ON SCATTERING AEROSOL AND ITS GENERATION FOR APPLICATION AS TRACER PARTICLES IN SUPERSONIC FLOW MEASUREMENTS UTILIZING LASER DOPPLER VELOCIMETER Technical Progress Report
M. K. Mazumder, B. D. Hoyle, and K. J. Kirsch 22 Apr. 1974 51 p refs
(Grant NGL-04-001-007; NASA-CR-138657) Avail: NTIS HC $5.75 CSCL 20D

An experimental study on the particle-fluid interactions of scattering aerosols was performed using monodisperse aerosols of different particle sizes for the application of laser Doppler velocimeters in subsonic turbulence measurements. Particle response was measured by subjecting the particles to an acoustically excited oscillatory fluid velocity field and by comparing the ratio of particle velocity amplitude to the fluid velocity amplitude as a function of particle size and the frequency of oscillation. Particle velocity was measured by using a differential laser Doppler velocimeter. The test aerosols were fairly monodisperse with a mean diameter that could be controlled over the size range from 0.1 to 1.0 micron. Experimental results on the generation of a fairly monodisperse aerosol of solid particles and liquid droplets and on the aerosol response in the frequency range 100 Hz to 100 kHz are presented. It is indicated that a unit density spherical scatterer of 0.3 micron-diameter would be an optimum choice as tracer particles for subsonic air turbulence measurements. Author

N74-26797*# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
AN ASSESSMENT OF TRANSIENT HYDRAULICS PHENOMENA AND ITS CHARACTERIZATION Final Report, 1 Apr. 1973 - 30 Jan. 1974
Richard W. Mortimer 15 Apr. 1974 47 p refs
(Grant NGR-39-004-051)
(NASA-CR-138650) Avail: NTIS HC $5.50 CSCL 20D

A systematic search of the open literature was performed with the purpose of identifying the causes, effects, and characterization (modelling and solution techniques) of transient hydraulics phenomena. The governing partial differential equations are presented which were found to be used most often in the literature. Detail survey sheets are shown which contain the type of hydraulics problem, the cause, the modelling, the solution technique utilized, and experimental verification used for each paper. References and source documents are listed and a discussion of the purpose and accomplishments of the study is presented. Author

N74-26798*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIMENTAL INVESTIGATION OF THE FLOW FIELD OF A HOT TURBULENT JET WITH LATERAL FLOW, PART 1
L. Harms Washington NASA Jun. 1974 60 p refs Transl. into ENGLISH of "Experimentelle Untersuchungen ueber das Stroemungsfeld eines heissen, turbulenten Strahles bei Queranstroemung, 1. Teilbericht", DFVLR, Brunswick, report, IB-157-73-A-18, 17 Sep. 1973 62 p
(Contract NASw-2483)
(NASA-TT-F-15707; IB-157-73-A-18) Avail: NTIS HC $6.00 CSCL 20D

A wind tunnel test was conducted to determine the three dimensional flow field of a hot round jet with the effect of a transverse flow using a nine hole probe at several intersection planes. The influence of various velocity and temperature conditions on the flow field was investigated. The measurements were compared with the results for the cold jet in a transverse flow. The data produced new laws regarding the mixing of a hot jet with its surroundings. Author

N74-26799*# Washington Univ., Seattle. Dept. of Mechanical Engineering.
CALCULATION OF TURBULENT SHEAR STRESS IN SUPERSONIC BOUNDARY LAYER FLOWS
Chen-Chih Sun and Morris E. Childs [1974] 35 p refs
(Grant NGR-48-002-047)
(NASA-CR-138659) Avail: NTIS HC $4.75 CSCL 20D

Turbulent shear stress distributions for supersonic boundary layer flows have been computed from experimental mean boundary layer data. The computations have been made by numerically integrating the time averaged continuity and streamwise momentum equations. Distributions have been obtained for flows upstream and downstream of shock-wave-boundary layer interactions and for both two-dimensional and axisymmetric flows. The computed results are compared with recently reported shear stress measurements which were obtained by hot wire anemometer and laser velocimeter techniques. Author

N74-26800*# National Bureau of Standards, Washington, D.C. Metallurgy Div.
THE ROLE OF CAVITATION IN MECHANICAL FAILURES Final Report
T. R. Shives, ed. and W. A. Willard, ed. Apr. 1974 188 p refs Presented at the 19th Meeting of the Mech. Failures Prevent. Group, Boulder, Colo., 31 Oct. - 2 Nov. 1973; sponsored by NASA, ONR and NBS
(NASA Order S-55581-A; Contract NAonr-70-74)
(NASA-CR-138633; LC-74-7057; NBS-SP-394) Avail: NTIS MF $0.95; SOD HC $2.25 as C13.10:394 CSCL 20D

The proceedings of a conference on the role of cavitation in mechanical failures are presented. The subjects discussed include the following: (1) physics associated with cavitation induced material damage, (2) practical examples of cavitation erosion and their prevention, (3) effects of viscoelasticity on cavitation in drag reducing fluids, (4) potential of thin, sputtered films as erosion resistance protective coatings, (5) rain droplet erosion mechanisms in transparent plastic materials, and (6) analysis of radome failure problems. For individual titles, see N74-26801 through N74-26817.

N74-26801* Naval Ship Research and Development Center, Bethesda, Md.
PHYSICS ASSOCIATED WITH CAVITATION INDUCED MATERIAL DAMAGE
F. B. Peterson *In* NBS The Role of Cavitation in Mech. Failures

Apr. 1974 p 3-12 refs (For availability see N74-26800 16-12)
CSCL 20D

The role of cavitation in mechanical failure is discussed. Some of the most common types of material damage associated with the presence of cavitation are surface material removal, delamination and structural vibration. This occurs in external flows such as on propellers, hydrofoils, and high speed non-lifting surfaces. In internal flows, pipe bends, inlets, constructions, pumps and turbines are typical. Nominally nonflowing liquids are also susceptible in, for example, strong acoustic fields and high energy particle detectors. For flowing systems, Bernoulli's equation shows how a local pressure is reduced as the fluid's velocity is increased. At sufficiently high velocities, a tension can actually develop and this has, in fact, been demonstrated experimentally. Once the pressure is reduced below the fluid vapor pressure a vapor cavity can be nucleated. Various aspects of this process are simply shown by considering the flow over a lifting surface.
Author

N74-26802* Catholic Univ. of America, Washington, D.C.
ROLE OF PHYSICAL PROPERTIES OF LIQUIDS IN CAVITATION EROSION
A. Thiruvengadam *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 13-22 refs (For availability see N74-26800 16-12)
CSCL 20D

The dependence of erosion rates on the ambient temperature of water is discussed. The assumption that the gas inside the bubble is compressed adiabatically during collapse gives better agreement with experiments than the assumption that the gas is isothermally compressed. Acoustic impedance is an important liquid parameter that governs the erosion intensity in vibratory devices. The investigation reveals that the major physical properties of liquids governing the intensity of erosion include density, sound speed, surface tension, vapor pressure, gas content, and nuclei distribution.
Author

N74-26803* General Electric Co., Schenectady, N.Y. Materials and Processes Lab.
THE ROLE OF MECHANICAL PROPERTIES IN CAVITATION EROSION RESISTANCE
G. C. Gould *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 23-30 refs (For availability see N74-26800 16-12)
CSCL 20D

Methods for determining the correlations of erosion resistance and mechanical properties of materials are discussed. The most common method of testing cavitation erosion resistance of materials is the vibratory cavitation probe. The instrument and its operation are described. The use of the whirling arm device is considered as a second method. Metallographic investigations of the earliest stages of cavitation erosion damage of metallic materials was conducted. The materials show plastic deformation occurring during the incubation period and increasing until cracks form and metal fragments are lost. The parameters of the work done to cause material fractures are identified. The reactions obtained with specific materials are reported.
Author

N74-26804* Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
RECENT THEORIES OF CAVITATION DAMAGE INCLUDING NON-SYMMETRICAL BUBBLE COLLAPSE EFFECTS
Frederick G. Hammitt *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 31-35 refs (For availability see N74-26800 16-12)
CSCL 20D

Theories of cavitation damage mechanisms are discussed. Photographic evidence has shown that the actual collapse of bubbles near a symmetry-destroying feature such as a nearby wall results in a toroidal-like collapse, with the final generation of a liquid microjet oriented toward the wall. Numerical analyses indicate that the shock wave intensity emitted during collapse is not likely to be strong enough to be damaging to most materials. It has been determined that actual damage is usually a result of a combination of impact effect of the microjet and the shock wave pressures generated by bubble rebounds.
Author

N74-26805* Hydronautics, Inc., Laurel, Md.
SOME PRACTICAL EXAMPLES OF CAVITATION EROSION AND THEIR PREVENTION
Andrew F. Conn *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 39-47 refs (For availability see N74-26800 16-12)
CSCL 20D

The problem of failures caused by cavitation erosion are discussed. The concepts of intensity of erosion, erosion strength, and the time dependence of erosion rate are analyzed. The relation of these parameters to system variables such as pressure and velocity, and to the properties of materials are investigated. Using several examples of actual cavitation erosion, methods of prevention and their limitations are examined.
Author

N74-26806* Sperry Vickers, Troy, Mich. System Science Labs.
EXAMPLES OF OIL CAVITATION EROSION IN POSITIVE DISPLACEMENT PUMPS
John A. Halat and G. O. Ellis *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 48-53 (For availability see N74-26800 16-12)
CSCL 20D

The effects of cavitation flow on piston type, positive displacement, hydraulic pumps are discussed. The operating principles of the pump and the components which are most subject to erosion effects are described. The mechanisms of cavitation phenomena are identified from photographic records. Curves are developed to show the solubility of air in water, oil-water emulsion, and industrial hydraulic oil.
Author

N74-26807* Bell Aerospace Co., Buffalo, N.Y.
MICROSCOPIC INVESTIGATION OF CAVITATION EROSION DAMAGE IN METALS c17
J. V. Hackworth and W. F. Adler *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 54-61 (For availability see N74-26800 16-12)
CSCL 11D

The results of research to identify the cavitation erosion damage mechanisms at the microscopic level for three metals (aluminum, stainless steel, and titanium) representing a range of properties and microstructure are presented. The metals were exposed to cavitation generated in distilled water by a 20-kHz ultrasonic facility operating at a vibration amplitude of 2 mils. Representative properties of the metals and experimental details are summarized. Replicas of the eroded surfaces of the specimens obtained periodically during exposure were examined with a transmission electron microscope to follow progression of the erosion damage and identify dominant erosion mechanisms as a function of exposure time. Eroded surfaces of selected specimens were also examined with a scanning electron microscope to assist in the interpretation.
Author

N74-26808* SKF Industries, Inc., King of Prussia, Pa. Technology Service Center.
LUBRICANT PRESSURE RIPPLING IN DYNAMIC HERTZIAN CONTACTS INDUCED BY SURFACE ROUGHNESS
T. E. Tallian and J. I. McCool *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 62-73 ref (For availability see N74-26800 16-12)
CSCL 11H

A numerical analysis of the pressure distribution of a lubricant in contact with a rough surface was conducted. The magnitude of the pressures was determined by their root mean square value for the contact of two dimensional cylinders. The pressure was found to vary in the following manner: (1) the location in the contact, (2) the spectrum or frequency content of the surface roughness, (3) the mean plateau film thickness, and (4) the root mean square value of the surface roughness. Mathematical models are developed to show the relationships of the parameters.
Author

N74-26809* Mechanical Technology, Inc., Latham, N.Y.
ASPERITY LUBRICATION AND CAVITATION IN FACE SEALS c15
J. A. Walowit *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 77-87 refs (For availability see N74-26800 16-12)
CSCL 11A

The basic aspect of parallel-surface lubrication that distinguishes it from other areas of lubrication technology is that

classical lubrication theory does not predict the existence of a stable hydrodynamic film for steady-state, isothermal, incompressible flow between smooth, parallel surfaces. Hydrodynamic films between apparently parallel surfaces have been observed in practice and are often essential for the reliable performance of thrust bearings and seals. In order to account for this fortunate discrepancy between classical theory and experiment, load-support mechanisms relating to accidential features chracteristic of seal performance, which relax one or more of the assumptions in the classical theory and permit the theoretical prediction of load support are proposed. Some of the features that have been analyzed are vibratory effects such as wobble and bounce, surface waveiness, nonsymmetric rotation resulting from various types of misalignment, lubricant density change, non-Newtonian lubricant effects, and surface roughness. Author

N74-26810* Pennsylvania State Univ., University Park.
EFFECT OF CAVITATION ON FLUID STABILITY IN POLYMER THICKENED FLUIDS AND LUBRICANTS
J. L. Duda and E. E. Klaus *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 88-99 refs (For availability see N74-26800 16-12)
CSCL 20D

The effects of cavitating flow on the polymeric additives used in functional fluids are described. A comparison of thermal and mechanical stability tests for these polymer solutions show distinct differences in the machanism of the polymer degradation. The thermal degradation tests appear to cause an unzippering or depolymerization type of reaction in which there is no particular selectivity based on molecular weight. The mechanical degradation of these fluids appears to be based on molecular weight. Measurements of molecular weight distributions during mechanical degradation show that for a given level of intensity only molecules above a certain minimum size are degraded. The effects of ultrasonic radiation on polymer degradation are reported. Tests were conducted to demonstrate the mechanism of mechanical polymer degradiation in an orifice. A more severe test than the orifice test in which two tapered roller bearings loaded against each other produce the mechanical breakdown is discussed. Author

N74-26811* Naval Research Lab., Washington, D.C.
EFFECTS OF VISCOELASTICITY ON CAVITATION IN DRAG REDUCING FLUIDS
Robert Y. Ting *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 100-106 refs (For availability see N74-26800 16-12)
CSCL 20D

To study cavitation inception in polymer solutions, a blow-down water tunnel with short running times was used. Tests were made using 1/4 and 1/2 inch diameter models of hemispherical-nose cylinders. To accurately detect the inception of cavitation, a reliable technique was developed using a continuously operating He-Ne gas laser. The laser beam was adjusted to grazing incidence with the model at the minimum pressure point where cavitation inception was to be expected. A sensitive photocell was placed at ninety degrees to detect the beam. As incipient cavitation occurred, the bubbles caused scattering of the laser beam which was picked up by the photocell. Static pressure near the model in the working section of the tunnel was measured using a solid-state pressure pick-up. The signals from the photocell and the pressure pick-up were recorded on an oscillograph. Velocity field visualization was achieved using one microsecond duration light pulses scattered by small polystryrene latex spheres in the flow. Author

N74-26812* Westinghouse Electric Corp., Lester, Pa. Steam Turbine Div.
PROGRESS AND PROBLEMS IN EROSION PREDICTION
Frank J. Heymann *In* NBS The Role of Cavitation in Mech. Failure Apr. 1974 p 107-114 refs (For availability see N74-26800 16-12)
CSCL 20D

Methods for predicting erosion resulting from repeated localized impulsive loadings, such a impacts from droplets or in cavitation flow from microjets and bubbles, are examined. The parameters which determine the adequacy of a component to resist the loads put upon it are identified. The development of erosion rate models is discussed. The expected accuracy of the prediction and the sources of error are analyzed. Author

N74-26813* Naval Air Development Center, Warminster, Pa.
POTENTIAL OF THIN, SPUTTERED FILMS AS EROSION RESISTANT PROTECTIVE COATINGS, PART 1 c18
Konrad Gentner and James E. Newhart *In* NBS The role of Cavitation in Mech. Failures Apr. 1974 p 117-128 Prepared in cooperation with Naval Air Propulsion Test Center, Trenton (For availability see N74-26800 16-12)
CSCL 11D

The characteristics of thin, pyrolytically deposited films for protection of surfaces from oxidation and abrasion are discussed. The limitations of depositing erosion resistant films are described. Environmental tests of first stage compressor blades in a T-58 engine after coating with a thin film were conducted. Photographic examples of the effectiveness of the thin films in protecting the turbine blades are provided. Methods for operating a sputtering system and the equipment used for film deposition are defined. Author

N74-26814* Naval Air Propulsion Test Center, Trenton, N.J.
EROSION AND THE GAS TURBINE ENGINE, PART 2 c28
J. E. Newhart *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 129-145 refs (For availability see N74-26800 16-12)
CSCL 21E

Procedures for protecting aircraft engines from impact damage due to sand and dust particles are discussed. One system is to develop a filtration system to remove most of the solid particles. Another method is to design blade materials and blade protection coatings. The concepts of erosion within aircraft engines are explained. Curves are presented to show the effect of impingement angle on ductile and elastic modes of erosion. Engine sand and dust ingestion tests were conducted on T63-A-5A engines and the results are produced in graph form. The results of tests conducted in a dynamic erosion facility are analyzed. Author

N74-26815* Air Force Materials Lab., Wright-Patterson AFB, Ohio. Elastomers and Coatings Branch.
RAIN DROPLET EROSION MECHANISMS IN TRANSPARENT PLASTIC MATERIALS c18
George F. Schmitt, Jr. *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 146-159 refs (For availability see N74-26800 16-12)
CSCL 11D

Tests were conducted to determine the damaging effects of rain erosion on optically transparent materials. The rotating arm test equipment used for the tests is described. Typical transparent materials such as those found in windshields, infrared windows, lasers, and television systems were tested. Nominal velocities of 400, 500, and 600 miles per hour and rainfall conditions of one inch per hour simulated rainfall were used in the tests. It was determined that an 80 percent reduction in laser transmittance can occur in plastics submitted to rain erosion. Significant results of the environmental tests are explained. Author

N74-26816* Naval Air Development Center, Warminster, Pa. Aeronautical Electronics Technology Dept.
ANALYSIS OF NAVY RADOME FAILURE PROBLEMS c18
G. J. Tatnall and K. Foulke *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 160-165 (For availability see N74-26800 16-12)
CSCL 11D

A survey of radome failure problems in military aircraft under actual operating conditions was conducted. The aircraft were operating from aircraft carriers in the Pacific Ocean. Critical problem areas were identified and a plan was developed for failure prevention. The development and application of repair kits for correcting the erosion damage are reported. It is stated that the rain erosion damage survey established a strong justification for qualification testing of all materials and designs which may have questionable life expectancy on the aircraft. Author

N74-26817* Naval Fleet Missile Systems, Corona, Calif. Analysis and Evaluation Group.
GOVERNMENT-INDUSTRY DATA EXCHANGE PROGRAM (GIDEP) c34
Edwin T. Richards *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 166-170 (For availability see N74-26800 16-12)
CSCL 05B

The Government-Industry Data Exchange Program (GIDEP) was originated in 1959 by the Army, Navy, and Air Force Ballistic Missile Agencies. Known at that time as IDEP--Interservice Data Exchange Program--its intent was to eliminate duplicate testing of parts and components by disseminating pertinent test data among Department of Defense contractors and various government agencies. In 1966 both the National Aeronautics and Space Administration and the Canadian Military Electronics Standards Agency (CAMESA) recognized the value of the data provided by the program and became participants. Today, GIDEP provides the interchange of specialized technical data to all the military services, participating government contractors and numerous government agencies such as the Atomic Energy Commission, Federal Aviation Administration, Defense Supply Agency, and the Small Business Administration. Author

N74-26818*# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
A STOCHASTIC MODEL OF TURBULENT MIXING WITH CHEMICAL REACTION: NITRIC OXIDE FORMULATION IN A PLUG-FLOW BURNER
Richard C. Flagan and John P. Appleton Dec. 1973 61 p refs
(Grants NGR-22-009-378; R-800-729-03-01)
(NASA-CR-138628; PUB-73-10) Avail: NTIS HC $6.25 CSCL 20D

A stochastic model of turbulent mixing was developed for a reactor in which mixing is represented by n-body fluid particle interactions. The model was used to justify the assumption (made in previous investigations of the role of turbulent mixing on burner generated thermal nitric oxide and carbon monoxide emissions) that for a simple plug flow reactor, composition nonuniformities can be described by a Gaussian distribution function in the local fuel:air equivalence ratio. Recent extensions of this stochastic model to include the combined effects of turbulent mixing and secondary air entrainment on thermal generation of nitric oxide in gas turbine combustors are discussed. Finally, rate limited upper and lower bounds of the nitric oxide produced by thermal fixation of molecular nitrogen and oxidation of organically bound fuel nitrogen are estimated on the basis of the stochastic model for a plug flow burner; these are compared with experimental measurements obtained using a laboratory burner operated over a wide range of test conditions; good agreement is obtained. Author

N74-26819*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAM FOR CALCULATION OF REAL GAS TURBULENT BOUNDARY LAYERS WITH VARIABLE EDGE ENTROPY
Lillian R. Boney Jun. 1974 240 p refs
(NASA-TM-X-71970) Avail: NTIS HC $6.00 CSCL 20D

A user's manual for a computer program which calculates real gas turbulent boundary layers with variable edge entropy on a blunt cone or flat plate at zero angle of attack is presented. An integral method is used. The method includes the effect of real gas in thermodynamic equilibrium and variable edge entropy. A modified Crocco enthalpy velocity relationship is used for the enthalpy profiles and an empirical correlation of the N-power law profile is used for the velocity profile. The skin-friction-coefficient expressions of Spalding and Chi and Van Driest are used in the solution of the momentum equation and in the heat-transfer predictions that use several modified forms of Reynolds analogy. Author

N74-26820*# Kanner (Leo) Associates, Redwood City, Calif.
GENERATION AND SUPPRESSION TURBULENCE IN AN AXISYMMETRIC TURBULENT JET IN THE PRESENCE OF AN ACOUSTIC INFLUENCE
Ye. V. Vlasov and A. S. Ginevskiy Washington NASA Jun. 1974 13 p refs Transl. into ENGLISH from IZV. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, Nov. - Dec. 1973 p 37-43
(Contract NASw-2481)
(NASA-TT-F-15721) Avail: NTIS HC $4.00 CSCL 20D

The results of an experimental study of the effect of sound of various intensities and frequencies on the parameters of an averaged and pulsating flow in a submerged turbulent jet are reported. It was demonstrated that both longitudinal and transverse irradiation of a jet causes either intensification or attenuation of turbulent mixing in the jet, depending on the acoustical signal frequency. Experimental data and theoretical considerations indicate that turbulence generation occurs when the periodic structure of the turbulent jet and the acoustical signal frequency are in resonance and that suppression occurs when the acoustical signal frequency exceeds the characteristic frequency of the periodic structure of the jet by approximately an order of magnitude. Author

N74-26821*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIMENTAL INVESTIGATION OF THE FLOW FIELD OF A HOT TURBULENT JET WITH LATERAL FLOW, PART 2
L. Harms Washington NASA 28 Sep. 1973 45 p refs Transl. into ENGLISH of "Experimentelle Vntersuchungen ueber das Stroemungsfeld eines heissen, turbulenten Strahles bei Queranstroemung, Teil 2", DFVLR, Goettingen, West Germany, report DFVLR-1-B-157-73-A-21, 28 Sep. 1973 50 p
(Contract NASw-2483)
(NASA-TT-F-15706; DFVLR-1-B-157-73-A-21) Avail: NTIS HC $5.25 CSCL 20D

The flow field of a hot round jet in a cross wind has been investigated in a three meter wind tunnel using a nine hole probe. The investigations were designed to produce information on the mixing processes of the jet and the cross flow, including the influence of temperature. For this purpose we measured the flow and temperature field of a heated round turbulent nozzle jet over several cross sections, at distances up to 30 nozzle diameters. Author

N74-26822# Advisory Group for Aerospace Research and Development, Paris (France).
THEORY OF FLOWS IN COMPRESSIBLE MEDIA WITH HEAT ADDITION
Juergen Zierep (Karlsruhe Univ.) May 1974 65 p refs
(AGARDograph-191; AGARD-AG-191) Avail: NTIS HC $6.25

A systematic survey is undertaken of the theory of the effect of a given heat addition on the flow of a compressible medium. Here steady flows, both one-dimensional and multi-dimensional, linear and nonlinear, are treated. Consideration is given to addition of mass and momentum to a streamtube as well as of energy. Interesting equivalences arise here. The heat can be distributed continuously in the flow field or added at fronts. For practical applications, the reduction of the drag of a body in flight by heat addition in the flow field is important. At extremely high velocities the problem arises of propulsion by external combustion. Here, the energy is to be transferred directly to the flowing medium, at the high velocity. For the evaluation of such an energy addition, reference is made to the propulsive efficiency, as well as the lift and drag of the body. Author

N74-26823*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPERIMENTAL AND THEORETICAL STUDY OF THE FLOW PHENOMENA WITHIN A VORTEX SINK RATE SENSOR Ph.D. Thesis - Old Dominion Univ.
Dashrath Khodidas Patel Jul. 1974 203 p refs
(NASA-TM-X-70179) Avail: NTIS HC $13.25 CSCL 20D

A description of the flow field within a vortex sink rate sensor was obtained, and the influence of viscous effects on its performance was observed. The sensor basically consisted of a vortex chamber and a sink tube. The vortex chamber consisted of two circular coaxial disks held apart, at their periphery, by a porous coupling. One circular disk had an opening to permit the mounting of the sink tube, in such a manner that the vortex chamber as well as the sink tube had a common axis of rotation. Air was supplied radially to the sensor through its porous coupling as the sensor was rotated at various speeds. Particular emphasis was directed toward an understanding of the flow

field in the sink tube region. Thus velocity measurements at various stations along the length of the sink tube as well as along a given radius at any designated station were taken.
Author

N74-26824# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
VISCOUS SUBLAYER THEORY FOR TURBULENT FLOW
A. L. Loeffler, Jr. Apr. 1974 45 p refs
(RE-471) Avail: NTIS HC $5.25

A structure of periodically growing and decaying laminar boundary layers is postulated for the sublayer in turbulent flow. After growing to a characteristic critical thickness they are swept away and new laminar boundary layers begin growing. Despite the seemingly deterministic nature of the model, it is compatible with the random property of turbulence because there is no preferred location of the pattern of laminar boundary layers upon the solid surface. The pattern will therefore tend to shift about randomly, and the behavior at a particular point near the surface will appear random. A mathematical development based on the physical model show dimensionless mean velocity and RMS turbulent velocity profiles that agree well with the experiments of laufer when breakdown is assumed to occur at Re sub x in the vicinity of 1.6 x 10,000. Reynolds stress variations with dimensionless distance from the wall show the correct general behavior. A three dimensional vortex system is suggested that is consistent with the flow development predicted by the present theory.
Author

N74-26825*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HOT-WIRE ANEMOMETRY IN HYPERSONIC HELIUM FLOW
Richard D. Wagner and Leonard M. Weinstein Washington Jun. 1974 45 p refs
(NASA-TN-D-7465; L-9238) Avail: NTIS HC $3.25 CSCL 20D

Hot-wire anemometry techniques are described that have been developed and used for hypersonic-helium-flow studies. The short run time available dictated certain innovations in applying conventional hot-wire techniques. Some examples are given to show the application of the techniques used. Modifications to conventional equipment are described, including probe modifications and probe heating controls.
Author

N74-26826*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF RATIO OF WALL BOUNDARY LAYER THICKNESS TO JET DIAMETER ON MIXING OF A NORMAL HYDROGEN JET IN A SUPERSONIC STREAM
Charles R. McClinton Washington Jun. 1974 42 p refs
(NASA-TM-X-3030; L-9455) Avail: NTIS HC $3.25 CSCL 20D

A preliminary experimental program was conducted to determine the effect of the ratio of the free-stream boundary-layer thickness to jet diameter on the secondary jet penetration and mixing rate. Tests were conducted on a flat plate in a Mach number 4.05 airflow with sonic injection of hydrogen normal to the free-stream direction from circular underexpanded injectors. The ratio of boundary-layer thickness to jet diameter ranged from 1.25 to 6.5. Previous correlations of mixing performance were modified to account for the effect of the ratio of boundary-layer thickness to jet diameter.
Author

N74-26827*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF MACH NUMBER ON PITOT-PROBE DISPLACEMENT IN A TURBULENT BOUNDARY LAYER
Jerry M. Allen Washington Jun. 1974 33 p refs
(NASA-TN-D-7466; L-9253) Avail: NTIS HC $3.25 CSCL 20D

Experimental pitot-probe-displacement data have been obtained in a turbulent boundary layer at a local free-stream Mach number of 4.63 and unit Reynolds number of 6.46 million meter. The results of this study were compared with lower Mach number results of previous studies. It was found that small probes showed displacement only, whereas the larger probes showed not only displacement but also distortion of the shape of the boundary-layer profile. The distortion pattern occurred lower in the boundary layer at the higher Mach number than at the the lower Mach number. The maximum distortion occurred when the center of the probe was about one probe diameter off the test surface. For probes in the wall contact position, the indicated Mach numbers were, for all probes tested, close to the true profile. Pitot-probe displacement was found to increase significantly with increasing Mach number.
Author

N74-26828# Aeronautical Research Labs., Melbourne (Australia).
COMPUTED AND MEASURED FAR-FIELD PRESSURE SIGNATURES OF ARTILLERY SHELLS
N. W. Page and A. S. Kaye Oct. 1973 37 p refs
(ARL/A-141) Avail: NTIS HC $5.00

The methods for determining the flow field around a supersonic projectile are discussed. The solutions are based on the use of the Whitham F-function, which represents the distribution of cross-sectional area along the length of the body. An alternative method is to use the inviscid method of characteristics to obtain the pressure distribution near the body. Quasi-linear theory can be used to project the solution into the far field. The types of artillery shells used in the tests are described. The test equipment required for data acquisition is identified.
Author

N74-26829# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXPERIMENTAL STUDY OF THE TRANSITION ZONES BETWEEN LAMINAR AND TURBULENT FLOW REGIONS IN INTERMITTENT PIPE FLOW [EXPERIMENTELLE UNTERSUCHUNG DER UEBERGANGSZONEN ZWISCHEN LAMINAREN UND TURBULENTEN TOROEMUNGSGEBIETEN IN INTERMITTENTER ROHRSTROEMUNG]
J. Meseth 1974 113 p refs In GERMAN; ENGLISH summary
(MPIS-Mitt-58) Avail: NTIS HC $8.75

The transition from laminar to turbulent flow and relaminarization was studied. Laminar pipe flow of water was obtained up to relatively high Reynolds-numbers. Disturbances were introduced by injection of a thin water jet so that a turbulent slug of pipe flow was produced. This resulted in intermittent pipe flow without significant change in mean flow velocity. Near the end of the pipe, five specially designed Pitot-tube probes were arranged across the pipe diameter. Their electric output was transformed into signals of instantaneous local flow velocity using a processing computer and from these velocity signals, turbulence intensity and short-time spectra of velocity fluctuations were obtained. The observed velocity fluctuations were significantly larger than in developed turbulent pipe flow; at the rear end of the turbulent region the amplitudes of the fluctuations were of the order of the mean flow velocity. The boundaries between laminar and turbulent regions are quite complicated, their streamwise dimensions are about 3 to 5 pipe diameters. A model is presented to interpret the observations.
Author (ESRO)

N74-26830# Oxford Univ. (England). Dept. of Engineering Science.
DEVELOPMENT OF THIN-FILM PROBES FOR VELOCITY MEASUREMENTS
J. K. Aggarwal 1974 43 p refs Sponsored by UK Sci. Res. Council
(Rept-1084/74) Avail: NTIS HC $5.25

Design data are presented on hot-film probes suitable for measuring velocities in two- and three-dimensional flow fields. For individual titles, see N74-26831 through N74-26832.

N74-26831 Oxford Univ. (England). Dept. of Engineering Science.
A THIN-FILM PROBE FOR TWO-DIMENSIONAL VELOCITY MEASUREMENTS c14
In its Develop. of Thin-Film Probes for Velocity Meas. 1974 17 p refs Sponsored by UK Sci. Res. Council (For availability see N74-26830 16-12)

The design and manufacture of a thin-film probe suitable for measuring the magnitude as well as the direction of a fluid velocity in one plane are described in detail. This probe was calibrated in water; calibrations are repeatable in the range 30 deg to 80 deg of the angle of incidence of the flow to the probe. The velocity range covered was from 0.04 to 1.60 m/s. Velocity

measurements in a two-dimensional wake of a model ship indicated its suitability for such measurements. Author (ESRO)

N74-26832 Oxford Univ. (England). Dept. of Engineering Science.
DEVELOPMENT OF A HOT-FILM GAUGE SUITABLE FOR THE MEASUREMENT OF A THREE-DIMENSIONAL VELOCITY VECTOR c14
In its Develop. of Thin-Film Probes for Velocity Meas. 1974 24 p refs Sponsored by UK Sci. Res. Council (For availability see N74-26830 16-12)

Design data are presented on hot-film probes suitable for measuring velocities in three-dimensional flow fields. Reliable calibrations were obtained in a towing tank using water as the medium. The principle of operation of these probes, the method of data acquisition, and the technique of computation of the magnitude and direction of the velocity vector are described. Author (ESRO)

N74-26833# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A KINETIC STUDY OF TRACER GAS DIFFUSION WITH RECOURSE TO A CASE OF FINITE FLOW VELOCITY
Tor Ytrehus and John F. Wendt Oct. 1973 85 p refs
(Grant NATO-591)
(VKI-TN-92) Avail: NTIS HC $7.25

The diffusion of a tracer gas from a porous boundary into an atmosphere of steady background gas was investigated. It was demonstrated that the kinetic part of the problem is mathematically equivalent to the Kramers problem of shear flow in a kinetic boundary layer, when the BGK-model is used to describe collisions between tracer and background molecules. A limited region of the macroscopic diffusion field was similarly found to have the asymptotic Couette flow as its analog. An experimental investigation was established to corroborate the theoretical results. The required experimental accuracy was found to be excessive so a finite flow velocity was allowed in a single-component gas. Density profiles were measured in the resulting kinetic boundary layer and the results compared to theoretical results. Author (ESRO)

N74-26834# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THEORETICAL AND REAL SLIP FACTOR IN CENTRIFUGAL PUMPS
A. Noorbakhsh Dec. 1973 42 p refs
(VKI-TN-93) Avail: NTIS HC $5.25

The slip factor is connected to the flow behavior in the blade passages. Such a flow having been considered, two slip factors were defined: theoretical and real. The theoretical slip factor will depend on the unavoidable slip of the nonviscous flow in the impeller channels. A distinction was made between two theoretical slip factors: the two dimensional one (FGT2) and the three dimensional one (FGT3) depending on the type of calculation process used to determine the factor. With the main geometrical parameters of the impeller systematically varied, a general table for FGT2 was established which can be very useful for the pumps designer. A detailed experimental study, covering five different impellers and involving the development of special instrumentation, provided the local and global values of FGR; the latter is strongly influenced by working conditions. A correlation between the real and theoretical slip factors was derived for any working condition; this allows a more accurate prediction of performance at off-design conditions. Author (ESRO)

N74-26835# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
A METHOD FOR THE GENERATION OF UNIFORM-SIZED DROPLETS BY BREAKING-UP A JET OF LIQUID
Guenter Requardt and Herbert Wiegand 1974 24 p refs
(DLR-FB-74-01) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. 10.90 DM

The theoretical conditions of the production and stability of jets of liquids and droplet sequences are given. The droplets are generated equal sized and equal spaced by the influence of sinusoidal mechanical vibration of a piezoelectric tubular transducer in a wide range of audio frequency. The droplet spacing can be increased by taking out specific numbers of them. This is done by charging and deflecting them, each in a suited electrostatic field. The charging is controlled by a frequency divider and high voltage pulse generator as final amplifier. The behavior and the trajectories of single droplets could be recorded and evaluated by photography and stroboscopy. Author (ESRO)

N74-26836# Royal Netherlands Meteorological Inst., De Bilt.
DESCRIPTION OF DATA PROCESSING FOR AUTORECORDING CURRENT METERS [BESCHRIJVING VAN DE VERWERKING VAN MEETRESULTATEN VAN ZELFREGISTRERENDE STROOMMETERS]
T. DeCrook and K. VanderVeen 1972 30 p In DUTCH
(V-241) Avail: NTIS HC $4.50

The computer programs for the processing of data recorded with two types of autorecording water current meters are described. The current meters are a Plessey, with a propeller and 4 channels. Both meters operate according to the same principle, for which the data are recorded in code on a magnetic tape. The computer programs not only process the data but verify and correct them. They have been written in ALGOL. ESRO

N74-26837# European Space Research Organization, Paris (France).
TURBULENT BOUNDARY LAYER WITH INJECTION OF THE SAME OR A DIFFERENT GAS AT THE POROUS WALL
Taieeb Lili May 1974 137 p refs Transl. into ENGLISH of "Couche Limite Turbulente avec Injection a la Paroi Proreuse d'un Meme Gaz ou d'un Gaz Different" ONERA-NT-201, ONERA, 1972
(ESRO-TT-47; ONERA-NT-201) Avail: NTIS HC $10.00
For abstract, see N73-22237.

N74-26838# California Inst. of Tech., Pasadena. Dept. of Applied Mathematics.
SINGULAR PERTURBATION OF NONLINEAR TWO-POINT BOUNDARY-VALUE PROBLEMS
Donald S. Cohen 1973 12 p
(Contract DAHC04-68-C-0006; Grant NSF GP-18471)
(AD-776442; AROD-7625-29-M) Avail: NTIS CSCL 20/4

The paper was motivated by certain nonlinear boundary-value problems which occur in fluid and gas dynamics. The author discusses them and some mathematical generalizations of them here. Specifically, the author is concerned with establishing the existence and asymptotic behavior for small epsilon > 0 of the solution of the nonlinear two-point boundary-value problem. Author (GRA)

N74-26839# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME ONE-DIMENSIONAL FLOW PROBLEMS FOR A TWO-PHASE GAS-VAPOR-LIQUID MIXTURE
Yu. N. Vasilev 11 Mar. 1974 41 p refs Transl. into ENGLISH from Sb. Statei Lopatochenye Mash. Struynye App. (USSR), no. 6, 1972 p 179-201
(AD-776887; FTD-HT-23-677-74) Avail: NTIS CSCL 20D

The report discusses a theory concerning a two-phase gas-liquid ejector. GRA

N74-26840# Bell Aerospace Co., Buffalo, N.Y.
ADVANCED EJECTOR THRUST AUGMENTATION STUDY - MASS ENTRAINMENT OF AXISYMMETRIC AND RECTANGULAR FREE JETS Final Report, Jun. 1972 - Apr. 1973
William Peschke Apr. 1973 68 p refs
(Contract F33615-72-C-2045; AF Proj. 6813)
(AD-776768; AFFDL-TR-73-55) Avail: NTIS CSCL 21/8

An experimental investigation has been performed to evaluate the entrainment characteristics of nonaxisymmetric rectangular primary nozzles for ejector into air application. Data are presented which show the variation in mass entrainment rates of various nozzles as related to isentropic nozzle exit velocity and distance downstream of the nozzle exit. The entrained mass flow is determined by direct measurement for an axisymmetric nozzle and for rectangular nozzles with aspect ratios of 1, 10, 25, and 50. Most of the data presented are for isentropic nozzle exit Mach numbers between about 0.08 and 0.3. Some data are presented for Mach numbers up to about 0.52. All data are for

nozzle exhausting into a quiescent atmosphere. (Modified author abstract) GRA

N74-26841# McDonnell-Douglas Astronautics Co., Titusville, Fla.
CLASSIFICATION OF FLUIDIC POWER SUPPLIES Final Report
W. J. Westerman, Jr. and G. W. Roe 21 Dec. 1973 67 p refs
(Contract DAAG39-73-C-0172)
(AD-777013; L0244) Avail: NTIS CSCL 13/7

The report documents the results of a program to derive a classification system for military fluidic power supplies on the basis of solid and liquid contaminants present in the gas. Both cold gas power supplies and hot gas power supplies were sampled. Sampling procedures were developed to take particulate, gravimetric and humidity samples of each power supply source. Sample results are presented in tabular form listing solid content, particle size spectra, oil content, and water content. A proposed Classification of Military Pneumatic Power Supplies is offered. (Modified author abstract) GRA

N74-26842*# Pennsylvania State Univ., University Park. Systems and Controls Lab.
[MATHEMATICAL AND COMPUTER MODELING AND ANALYSIS OF ENGINEERING SYSTEMS] Research Report, Jul. 1973
Gary V. Smith, W. D. Mangieri, Huan C. Tran, and R. Yaros Jul. 1973 15 p refs
(Grant NGR-39-009-023; Contract DAAG39-72-C-0190)
(NASA-CR-138695; AD-776401; PSU-SCL-16(73A); RR-16) Avail: NTIS HC $4.00 CSCL 20/4

The Systems and Controls Laboratory encourages graduate research and development on engineering systems, with emphasis on bridging the gap between theory and practice. Much of the work involves mathematical and computer modeling and analysis. A major part of this work devoted to advanced engineering in aerospace systems. GRA

N74-26843# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
NUMERICAL SOLUTION OF INTERACTING SUPERSONIC BOUNDARY LAYER FLOWS INCLUDING SEPARATION EFFECTS
M. J. Werle and V. N. Vatsa Wright-Patterson AFB, Ohio ARL Dec. 1973 118 p refs
(Contract F33615-73-C-4014; AF Proj. 7064)
(AD-777570; ARL-73-0162) Avail: NTIS CSCL 20/4

An efficient numerical solution algorithm is presented for solving the interacting supersonic laminar boundary layer problem. The method employs a time dependent approach with the alternating direction implicit (ADI) scheme and directly accounts for the necessary downstream boundary condition. Solutions are presented for (M sub infinity) = 3 cold wall boundary layer flow over a family of expansion and compression ramps including several cases with regions of reverse flow. Good comparison is given with experimental data and Navier Stokes solutions for (M sub infinity) = .4, adiabatic wall, separated flow up a ten degree compression ramp. Author (GRA)

N74-26844# Naval Ordnance Lab., White Oak, Md.
COMPRESSIBLE TURBULENT SKIN FRICTION ON ROUGH AND ROUGH/WAVY WALLS IN ADIABATIC
Daniel C. Reda 12 Feb. 1974 68 p refs
(AD-777385; NOLTR-74-34) Avail: NTIS CSCL 20/4

An experimental program was conducted to investigate effects of roughness, and roughness superimposed on single and/or multiple, shallow, periodic waveforms, on turbulent boundary-layer skin friction and velocity profile, in compressible, adiabatic flow. Test conditions were Mach number = 2.9 and Reynolds number/ft = 2 million to 8 million. The planar models included smooth, sandgrain, machined and molded surface finishes. Direct measurements of surface shear and Pitot/recovery temperature profiles were obtained. (Modified author abstract) GRA

N74-26845# Naval Intelligence Support Center, Washington, D.C. Translation Div.
TWO-COMPONENT SUPERSONIC FLOW AROUND SLENDER BODIES
N. Mamadailiev 14 Nov. 1973 11 p refs Transl. into ENGLISH from the publ. "Teplo i Massoperenos. Volume 2: Teplo-Massoperanos pri Vzaimodeistvii tel s Potokami Zhidkostei Gazov" Minsk, 1965 p 189-197
(AD-777410; NISC-Trans-3472) Avail: NTIS CSCL 20/4

When solving the problem of a two-component supersonic flow around slender bodies it is useful to proceed from a theory of the motion of multicomponent media. For isothermal flow the sound velocities are constant for both phases. This problem was solved earlier in the laboratory using the method of characteristics in the presence of boundary conditions analogous to a single-component flow. GRA

N74-26846# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
MEASUREMENTS OF TURBULENT BOUNDARY LAYER GROWTH OVER A LONGITUDINALLY CURVED SURFACE
R. N. Meroney Jan. 1974 82 p refs
(Contract N00014-68-A-0493-0001; NR Proj. 062-414)
(AD-777455; CER73-74RNM-26; THEMIS-CER-TR-25) Avail: NTIS CSCL 20/4

The result of an additional rate of strain on a turbulent parcel of fluid as it undergoes even mild streamline curvature can be very large. Until recently skin friction and heat transfer calculations have ignored this effect. Recent measurements over turbine cascades suggest that curvature influences heat transfer by an order of magnitude. In addition there exists a strong analogy between the effects of centrifugal body forces and the buoyance body force arising in density stratified flow in a gravity field. This note reports the results of a set of measurements of boundary layer development over convex and concave surfaces and compares the results with various turbulence models utilized in computational programs. A moderate curvature wind tunnel test section was constructed to examine the influence of curvature on boundary layer structure. (Modified author abstract) GRA

N74-26847# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GRID-CHARACTERISTIC METHOD OF CALCULATING PLANE AND AXISYMMETRICAL SUPERSONIC TWO-PHASE FLOWS
L. P. Vereshchaka, A. N. Kraiko, and L. E. Sternin 3 Apr. 1974 27 p refs Transl. into ENGLISH from Sb. Statei, Lopatochnye Mashiny i Struynye App. (USSR), no. 6, 1972 p 163-178
(AD-777662; FTD-HT-23-676-74) Avail: NTIS CSCL 20/4

Two-phase flows in ejector devices (nozzles and ejectors) and in bladed machines (turbines) have gained increasing interest on the part of researchers. In addition to one-dimensional calculation methods for supersonic plane and axisymmetrical two-phase flows, exact numerical methods have also been developed. Most studies have been based on the usual method of characteristics, but computer programs based on this system are generally complex from the logic standpoint. For this reason it is desirable to develop a system which is the reverse of the characteristics method which has simple logic. GRA

N74-26452 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
BOUNDARY LAYER CALCULATION METHODS AND APPLICATION TO AERODYNAMIC PROBLEMS
J. Steinheuer *In* AGARD Prediction Methods for Aircraft Aerodyn. Characteristics May 1974 48 p refs (For availability see N74-26445 16-02)

N74-26925 Waterloopkundig Laboratorium, Delft (Netherlands).
TRANSPORT OF POLLUTANTS OR HEAT IN A SYSTEM OF CHANNELS
J. C. W. Berkhoff *In* Comm. for Hydrol. Res. TNO Hydraulic Res. for Water Management 1973 p 80-106 refs (For availability see N74-26921 16-13)

N74-26926 Waterloopkundig Laboratorium, Delft (Netherlands).
PRACTICAL APPLICATIONS OF COMPUTATIONS FOR CHANNEL NETWORKS
C. Veeningen *In* Comm. for Hydrol. Res. TNO Hydraulic Res.

for Water Management 1973 p 107-140 ref (For availability see N74-26921 16-13)

N74-27284 Detroit Diesel Allison, Indianapolis, Ind.
UNSTEADY CASCADE FLOW: A SCHLIEREN STUDY
R. B. McClure *In its* Aeroelasticity in Turbomachines 1 Jun. 1972 p 101-109 (For availability see N74-27281 16-28)

N74-27286 General Electric Co., Schenectady, N.Y.
UNSTEADY CASCADE AERODYNAMICS INCLUDING COMPRESSIBILITY EFFECTS
R. Mani *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 140-150 refs (For availability see N74-27281 16-28)

N74-27289 Naval Postgraduate School, Monterey, Calif.
UNSTEADY TRANSONIC AND SUPERSONIC CASCADE FLOWS
M. F. Platzer *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 196-214 refs (For availability see N74-27281 16-28)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-26848 Maryland Univ., College Park.
THE EFFECT OF EXTRATERRESTRIAL DUST, STRATOSPHERIC WARMINGS, AND LOWER THERMOSPHERIC PRESSURE SYSTEMS ON OGO-4 MEASURED NIGHTGLOWS IN THE EARTH'S ATMOSPHERE (80 TO 100 km) Ph.D. Thesis
Jearl Dalton Walker, Jr. 1973 204 p
Avail: Univ. Microfilms Order No. 74-11671

Photometric measurements of four upper D and lower E region nightglows are investigated. World-wide maps of the night-glow distribution and deviations from daily zonal averages are given, and analysis of the variation in nightglow intensities is made. From this distribution, pressure systems operating in the nightglow altitudes are deduced, though the source of these systems is not determined. Dissert. Abstr.

N74-26849 Department of Energy, Mines and Resources, Ottawa (Ontario).
AN AUTOMATIC MAGNETIC OBSERVATORY SYSTEM Publications of the Earth Physics Branch, Volume 44, No. 11
F. Andersen 1974 14 p refs
Copyright. Avail: Issuing Activity

A digitally recording magnetometer system is designed to replace the standard photographic magnetographs at geomagnetic observatories. The instrument can operate for up to 80 days without attention. Provision is made for immunity to brief power failures. The elements D, H, and Z are derived from a 3-component fluxgate magnetometer in which all three detectors operate in near-zero field. A simple proton magnetometer measures F. Voltages proportional to the values of the three elements D, H, and Z are sampled in quick succession by a digital voltmeter, once per minute. Each minute, a measurement of F is also made. The four measurements are recorded on digital magnetic tape. Each ten minutes, the date, time, and station identification are also recorded. A strip-chart recorder produces a visual indication of the variations in D, H, and Z. The performance of the system is estimated. Author

N74-26850 Rensselaer Polytechnic Inst., Troy, N.Y.
ON SYSTEMS ANALYSIS AND ENVIRONMENTAL MODELING Ph.D. Thesis
Peter J. R. Buttner 1974 313 p
Avail: Univ. Microfilms Order No. 74-12780

The systems-analytic approach to problem analysis and solution provides a powerful tool for the study of modern and ancient environmental systems. The systems concept is reviewed, and an introduction to the methods of systems analysis is given together with a discussion of system modeling. Application of the concept is illustrated by presenting the preliminary results of the analysis of a modern river system. A comprehensive data base on the topology, hydrodynamics and geomorphology of this basin, the Bozenkill, is developed and presented. To supplement these data and provide information on channel process as well as channel response, experiments were performed to illustrate: the system's discharge dynamics; the use of the system's network to evaluate various equations that have been used to calculate the paleohydrodynamics of ancient river systems; and, the use of these data to build several system models. Dissert. Abstr.

N74-26851 Maryland Univ., College Park.
AN EXPERIMENTAL OBSERVATION OF WHISTLER TRIGGERED ELECTRON-CYCLOTRON INTERACTIONS IN THE MAGNETOSPHERE Ph.D. Thesis
John Carl Foster 1973 186 p
Avail: Univ. Microfilms Order No. 74-11651

The observation of bresstrahlung X-rays produced by the electron precipitation associated with the generation of bursts of discrete VLF emissions is analyzed. The 1 sec bursts of X-rays with energies > 30 kev were measured at balloon altitude over Siple Station, Antarctica (L=4.2) on January 2, 1971. A one-to-one correlation with whistler triggered bursts of VLF rising tones in the 1500-3800 Hz frequency range was observed for approximately 25 min. Cross correlation and power spectral analysis of the X-ray count rate and VLF amplitude are presented. Propagation characteristics of VLF waves and electrons in the magnetosphere are investigated. A approximately 0.2 sec time delay between the reception of the VLF bursts and the corresponding X-rays is explained in terms of an equatorial electron-cyclotron interaction taking place outside the plasmapause. Northward traveling electrons interact with southward traveling waves. Dissert. Abstr.

N74-26852 Illinois Univ., Urbana.
ELECTRON COLLISION PROCESSES IN THE IONOSPHERE Ph.D. Thesis
George Panagiotis Mantas 1973 378 p
Avail: Univ. Microfilms Order No. 74-12098

A review of electron gas temperatures, the predawn electron gas temperature and the predawn OI (6300 A) airglow intensity enhancement, reveals the need for a re-examination of the electron gas cooling and heating rates, and the need of a rigorous theoretical study of the thermalization and transport of photoelectrons in the earth's atmosphere. The rate of energy exchange, through elastic collisions, between two gases in thermal disequilibrium is derived from elementary considerations. This formula is applied to calculate energy transfer rates, and collision frequencies for energy transfer, plasmas at thermal disequilibrium. It is shown that electron/ion energy transfer rates and collision frequencies for energy transfer are overestimated by 5 to 37%, depending on the electron density and electron and ion temperatures, when the classical Coulomb logarithm ln Lambda appears in these expressions. Dissert. Abstr.

N74-26853 Cornell Univ., New York.
AIRGLOW AND INCOHERENT SCATTER STUDIES OF THE DYNAMICS OF THE NIGHTTIME IONOSPHERE AT ARECIBO Ph.D. Thesis
Jose Humberto Andrade Sobral 1973 194 p
Avail: Univ. Microfilms Order No. 74-10214

Red (6300A) and green (5577A) airglow data obtained at Arecibo during nighttime are analyzed. Some of the 6300A airglow measurements were made with a photometer scanning in the meridional plane. These measurements permitted the determinations of the direction and velocity of propagation of major collapse of the ionosphere near Arecibo. The most important of these (the midnight collapse) was observed to propagate from south to north with a phase velocity of the order of 350m/s. Other collapses (and the resulting airglow enhancements) traveled either from south to north or occurred simultaneously at all latitudes. It is believed that these three types of airglow enhancements are caused by neutral wind changes, TID's, and dynamo electric fields, respectively. Dissert. Abstr.

N74-26854 Colorado Univ., Boulder.
SOURCES AND SINKS OF ENERGY IN THE LOWER

THERMOSPHERE Ph.D. Thesis
Gene Wylie Adams 1973 249 p
Avail: Univ. Microfilms Order No. 74-12351

The sources and sinks of energy in the sub-auroral lower thermosphere (80-150 km) have been investigated. Heating and cooling rates due to molecular thermal conduction have been calculated including variations with altitude, latitude, season, and solar activity. Molecular thermal conduction cools the atmosphere above (typically) 125 km and heats below, although the cross-over altitude varies strongly with solar activity. Solar photo absorption in the 40-3000A region has been calculated, with allocation of the initially absorbed energy into ionization, dissociation, excitation, and direct heating. These calculations have been done as a function of altitude, latitude, season, and wavelength. Detailed results for molecular thermal conduction and solar photon absorption, and the identification and estimation of other important processes are provided. Dissert. Abstr.

N74-26855 Stanford Univ., Calif.
AIR-WATER INTERACTION: THE NATURE OF TURBULENT HEAT, MASS, AND MOMENTUM TRANSFER MECHANISMS IN THE AIR BOUNDARY LAYER Ph.D. Thesis
Michael Bau On Ypung 1974 197 p
Avail: Univ. Microfilms Order No. 74-13709

Two experimental configurations were investigated. These were a flat, smooth, solid surface heated from below to provide base line data, and a free water surface configuration which provided the environment for air-water interaction experiments. Results of the air-water interaction experiment showed that heat and momentum transfer similarity no longer held. Free surface heat and momentum transfers increased relative to the smooth, solid surface results. Mass transfers are also postulated to be larger than the flat plate results. The thermal field and heat transfer processes were greatly affected by the change in the boundary condition from smooth and solid to free water surface. Dissert. Abstr.

N74-26856*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Apr. 1974
Richard F. Nalepka and William A. Malila, Principal Investigators 24 May 1974 2 p EREP
(Contract NAS9-13280)
(E74-10512; NASA-CR-138262; ERIM-101900-30-L; MPR-14) Avail: NTIS HC $4.00 CSCL 05B

There are no author-identified significant results in this report.

N74-26857*# City Coll. of the City of New York. University Inst. of Oceanography.
A JOINT METEOROLOGICAL, OCEANOGRAPHIC AND SENSOR EVALUATION PROGRAM FOR EXPERIMENT S193 ON SKYLAB Monthly Plans and Progress Report, period ending 13 Mar. 1974
Willard J. Pierson, R. K. Moore, and E. P. McClain, Principal Investigators 13 Mar. 1974 3 p EREP
(Contract NAS9-13642)
(E74-10514; NASA-CR-138264) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-26858*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
UTILIZATION OF ERTS-A DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA Progress Report, Apr. - May 1974
Charles W. Welby, Principal Investigator 6 Jun. 1974 1 p ERTS
(Contract NAS5-21732)
(E74-10519; NASA-CR-138253) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N74-26859*# Rockwell International Science Center, Thousand Oaks, Calif.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM ERTS-1 IMAGERY Progress Report, 1 Apr. - 31 May 1974
Monem Abdel-Gawad, Principal Investigator 4 Jun. 1974 2 p ERTS
(Contract NAS5-21767)
(E74-10520; NASA-CR-138269; SC543.12PR) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. The transverse faults observed in the central Coast Ranges of California are believed to represent the remnants of a major system of shear faults older than the San Andreas system. The transverse shear system is believed to have developed in the Mesozoic when the Pacific Plate was advancing under the North American Plate. Shear faults thus developed due to unequal rates of underthrusting. This tectonic model indicates that the intrusive belt of the proto-Sierra Nevada and the belt of eugeosynclinal sedimentary belt (Franciscan group) which lay to the west were both subjected to regional left-handed shear. Later development of the San Andreas system as transform faults of the East Pacific Rise changes the tectonic style to right-lateral tangential. The model explains the peculiar distribution of the Franciscan rocks in the Diablo Range east of the San Andreas fault and in Santa Lucia Range west of Nacimiento fault and the presence of Sierra Nevada type granitic blocks in between the two faults in the Salinia block. This model is also consistent with an analysis of the Texas and Parras shears which indicates that the southwestern part of North America has been subjected to a major left-lateral regional shear before the development of the San Andreas fault system.

N74-26860*# Geological Survey, Denver, Colo.
REMOTE SENSING GEOPHYSICS FROM SKYLAB Monthly Report, May 1974
Kenneth Watson, Principal Investigator and H. A. Pohn May 1974 2 p EREP
(NASA Order T-6555-B)
(E74-10521; NASA-CR-138270) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N74-26861*# Tri-State Regional Planning Commission, New York.
INVESTIGATION OF SKYLAB IMAGERY FOR REGIONAL PLANNING Quarterly Progress Report, 1 Jan. - 31 Mar. 1974
William Harting, Principal Investigator 31 Mar. 1974 1 p EREP
(Contract NAS9-13266)
(E74-10523; NASA-CR-138272; QPR-3) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-26862*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Apr. 1974
Roger M. Hoffer, Principal Investigator Apr. 1974 12 p EREP
(Contract NAS9-13380)
(E74-10524; NASA-CR-138273) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-26863*# Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.
EVALUATION OF SKYLAB IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-30 Apr. 1974
Ernest E. Hardy, Principal Investigator 30 Apr. 1974 2 p

EREP
(Contract NAS9-13364)
(E74-10527; NASA-CR-138276) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-26864*# National Environmental Satellite Service, Hillcrest Heights, Md.
EVALUATION OF ERTS DATA FOR CERTAIN OCEANOGRAPHIC USES Bimonthly Report, Jan. - Apr. 1974
Alan E. Strong, Principal Investigator Apr. 1974 4 p refs ERTS
(NASA Order S-70246-AG)
(E74-10546; NASA-CR-138295; BMR-11; BMR-12) Avail: NTIS HC $4.00 CSCL 08C

The author has indentified the following significant results. According to Lake Michigan records, the pH levels have been steadily increasing as the lake becomes more eutrophic. Numerous upwellings during the summer of 1973, beginning with the late July event, appear to be triggering a chemical precipitation of calcium carbonate. The upwelling provides abundant carbon dioxide into the surface water and results in massive blooms of phytoplankton. As the CO2 is utilized by these microscopic plants the pH is increased (acidity decreases) and CaCO3 no longer is able to remain in solution. The precipitation takes place where the phytoplankton are living, near depths of 10 meters. Therefore, the whiting observed by ERTS-1 is only seen in the green band, as red cannot penetrate but a few meters. With these whitings, secci disc readings lower in July from 10-15 meters to 3-5 meters and green, milky water is observed by research vessels. It appears that whitings have been becoming more frequent since the middle 60's but until ERTS-1 the extent had never been realized. Calcium levels are too low, presently, for a similar precipitate in Lakes Huron or Superior. However, whitings have been seen by ERTS-1 in Lakes Erie and Ontario where the calcium ion and pH levels are more like those found in Lake Michigan.

N74-26865*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF TIME LAPSE DATA PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 6 Mar. - 6 May 1974
Sidney M. Serebreny, Principal Investigator 16 May 1974 5 p ERTS
(Contract NAS5-21841)
(E74-10552; NASA-CR-138442) Avail: NTIS HC $4.00 CSCL 08H

There are no author-identified significant results in this report.

N74-26866*# Bureau of Sport Fisheries and Wildlife, Jamestown, N. Dak. Northern Prairie Wildlife Research Center.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, May 1974
Harvey K. Nelson, Principal Investigator May 1974 2 p EREP
(NASA Order T-4114-B)
(E74-10557; NASA-CR-138447) Avail: NTIS HC $4.00 CSCL 06C

There are no author-identified significant results in this report.

N74-26867*# Texas Univ., Dallas.
CARBON DIOXIDE IN THE ATMOSPHERE Semiannual Status Report
F. S. Johnson 11 Jan. 1974 19 p
(Grant NGL-44-004-026)
(NASA-CR-138651) Avail: NTIS HC $4.00 CSCL 04A

Research projects for the period ending September 15, 1973 are reported as follows: (1) the abundances of carbon dioxide in the atmosphere, and the processes by which it is released from carbonate deposits in the earth and then transferred to organic material by photosynthesis; the pathways for movement of carbon and oxygen through the atmosphere; (2) space science computation assistance by PDP computer; the performance characteristics and user instances; (3) OGO-6 data analysis studies of the variations of nighttime ion temperature in the upper atmosphere. A.A.D.

N74-26868*# Pacific Northwest Forest and Range Experiment Station, Portland, Oreg. Remote Sensing Research Work Unit.
MONITORING FOREST LAND FROM HIGH ALTITUDE AND FROM SPACE Remote Sensing Applications in Forestry. Final Report
Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1972 200 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab. in cooperation with Dept. of Agric. Forest Serv.
(NASA Order R-09-038-002)
(NASA-CR-138624) Avail: NTIS HC $13.00 CSCL 02F

The significant findings are reported for remote sensing of forest lands conducted during the period October 1, 1965 to December 31, 1972. Forest inventory research included the use of aircraft and space imagery for forest and nonforest land classification, and land use classification by automated procedures, multispectral scanning, and computerized mapping. Forest stress studies involved previsual detection of ponderosa pine under stress from insects and disease, bark bettle infestations in the Black Hills, and root disease impacts on forest stands. Standardization and calibration studies were made to develop a field test of an ERTS-matched four-channel spectrometer. Calibration of focal plane shutters and mathematical modeling of film characteristic curves were also studied. Documents published as a result of all forestry studies funded by NASA for the Earth Resources Survey Program from 1965 through 1972 are listed. A.A.D.

N74-26869*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
BASIC RESEARCH AND DATA ANALYSIS FOR THE NATIONAL GEODETIC SATELLITE PROGRAM AND FOR THE EARTH AND OCEAN PHYSICS APPLICATION PROGRAM Semiannual Status Report, Jul. - Dec. 1973
Jan. 1974 117 p refs
(Grants NGL-36-008-093; NGL-36-008-204; OSURF Proj. 2514; OSURF Proj. 3820-A1)
(NASA-CR-138671; SASR-13) Avail: NTIS HC $9.00 CSCL 05B

Accomplishments in the continuing programs are reported. The data were obtained in support of the following broad objectives: (1) to provide a precise and accurate geometric description of the earth's surface; (2) to provide a precise and accurate mathematical description of the earth's gravitational field; and (3) to determine time variations of the geometry of the ocean surface, the solid earth, the gravity field, and other geophysical parameters. Author

N74-26870# National Ocean Survey, Rockville, Md. Geodetic Research and Development Lab.
EARTH'S GRAVITY FIELD STATION COORDINATES FROM DOPPLER DATA, SATELLITE TRIANGULATION, AND GRAVITY ANOMALIES
Karl-Rudolf Koch Feb. 1974 32 p refs
(NOAA-TR-NOS-62) Avail: SOD HC $0.65

A solution for the earth's gravitational field represented by the potential of a simple layer is obtained by means of the analysis of 108,491 observations from 21 weeks of Doppler data from 41 stations to seven satellites. In a combined solution, gravity anomalies are added to satellite observations. The results for 17 stations of the worldwide satellite triangulation tied by survey to corresponding Doppler stations are introduced into the combined solution so that coordinates of 41 Doppler stations and 17 stations of the satellite triangulation are obtained. The semimajor axis of the best fitting ellipsoid of the combined solution equals 6,378,134 m and its flattening 1/298.254. Author

N74-26871*# Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
MIXING ZONES STUDIES OF THE WASTE WATER DISCHARGE FROM THE CONSOLIDATED PAPER COMPANY INTO THE WISCONSIN RIVER AT WISCONSIN RAPIDS, WISCONSIN
John A. Hoopes, Dong-Shan Wu, and Ramesh Ganatra Mar. 1973 71 p refs Original contains color illustrations
(Grant NGL-50-002-127)

(NASA-CR-138517) Avail: NTIS HC $6.75 CSCL 08H

Effluent concentration distributions from the waste water discharge of the Kraft Division Mill, Consolidated Paper Company, into the Wisconsin River at Wisconsin Rapids, Wisconsin, is investigated. Effluent concentrations were determined from measurements of the temperature distribution, using temperature as a tracer. Measurements of the velocity distribution in the vicinity of the outfall were also made. Due to limitations in the extent of the field observations, the analysis and comparison of the measurements is limited to the region within about 300 feet from the outfall. Effects of outfall submergence, of buoyancy and momentum of the effluent and of the pattern and magnitude of river currents on these characteristics are considered. Author

N74-26872# National Oceanic and Atmospheric Administration, Boulder, Colo.

Nu-AVERAGED INFRARED ABSORPTION COEFFICIENTS OF WATER VAPOR

R. F. Calfee and R. L. Schwiesow Aug. 1973 23 p refs

(NOAA-TR-ERL-274-WPL-24) Avail: SOD HC $0.55

The quantitative absorption coefficients of water vapor are presented in a format suitable for calculation of water vapor absorption spectra characterized by instrumental bandpasses of 1 per centimeter or greater in the 670 to 1450 1 per centimeter region. These coefficients are derived from individual line parameters of H2O and represent a useful way of reducing line parameter data to a practical volume of information for 1 per centimeter resolution spectra of the troposphere. Transmission spectra for three water vapor concentrations show typical applications of the absorption coefficient tables. The application of the data is restricted to conditions within 10% of 1 atmosphere pressure and a temperature of 296 K if a transmission accuracy of 2% is to be maintained. Author

N74-26873# American Gas Association, Arlington, Va.

ACTION IN THE ATLANTIC: A VITAL STEP FOR OUR NATION'S ENERGY AND ENVIRONMENTAL NEEDS

[1974] 18 p

(G-70172-100M8.73-408) Avail: NTIS HC $4.00

The offshore exploration of the Atlantic Continental Shelf is discussed in terms of the increasing energy demands. Gas and oil reserves, petroleum geology, and undersea drilling are breifly described. F.O.S.

N74-26874*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

ELECTRON COLLECTION THEORY FOR A D-REGION SUBSONIC BLUNT ELECTROSTATIC PROBE

Thomas Wai-Kwong Lai 20 May 1974 147 p refs

(Grants NGR-39-009-218; NGL-39-009-003)

(NASA-CR-138518; PSU-IRL-SCI-424) Avail: NTIS HC $10.50 CSCL 03B

Blunt probe theory for subsonic flow in a weakly ionized and collisional gas is reviewed, and an electron collection theory for the relatively unexplored case, Deybye length approximately 1, which occurs in the lower ionosphere (D-region), is developed. It is found that the dimensionless Debye length is no longer an electric field screening parameter, and the space charge field effect can be negelected. For ion collection, Hoult-Sonin theory is recognized as a correct description of the thin, ion density-perturbed layer adjacent the blunt probe surface. The large volume with electron density perturbed by a positively biased probe renders the usual thin boundary layer analysis inapplicable. Theories relating free stream conditions to the electron collection rate for both stationary and moving blunt probes are obtained. A model based on experimental nonlinear electron drift velocity data is proposed. For a subsonically moving probe, it is found that the perturbed region can be divided into four regions with distinct collection mechanisms. Author

N74-26875*# Nebraska Univ., Lincoln.

APPLICATIONS OF REMOTE SENSING IN RESOURCE MANAGEMENT IN NEBRASKA Semiannual Progress Report, Jan. - Jun. 1974

James V. Drew Jun. 1974 28 p refs

(Grant NGL-28-004-020)

(NASA-CR-138602) Avail: NTIS HC $4.50 CSCL 08F

The project is reported for studying the application of remote sensing in land use classification and delineation of major tectonic lineaments in Nebraska. Other research reported include the use of aircraft and ERTS-1 satellite imagery in detecting and estimating the acreage of irrigated land, and the application of remote sensing in estimating evapotranspiration in the Platte River Basin. F.O.S.

N74-26876*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.

USE OF REMOTE SENSING IN AGRICULTURE Contractor Report, Jul. 1970 - Jun. 1973

David E. Pettry, Norris L. Powell, and Michael E. Newhouse Jan. 1974 151 p refs

(Contract NAS6-1863)

(NASA-CR-62098) Avail: NTIS HC $10.75 CSCL 02C

Remote sensing studies in Virginia and Chesapeake Bay areas to investigate soil and plant conditions via remote sensing technology are reported ant the results given. Remote sensing techniques and interactions are also discussed. Specific studies on the effects of soil moisture and organic matter on energy reflection of extensively occurring Sassafras soils are discussed. Greenhouse and field studies investigating the effects of chlorophyll content of Irish potatoes on infrared reflection are presented. Selected ground truth and environmental monitoring data are shown in summary form. Practical demonstrations of remote sensing technology in agriculture are depicted and future use areas are delineated. Author

N74-26877*# Alaska Univ., College. Geophysical Inst.

ROCKET INVESTIGATIONS OF THE AURORAL ELECTROJET Final Report

T. Neil Davis Oct. 1973 5 p refs

(Grant NGR-02-001-025)

(NASA-CR-138592) Avail: NTIS HC $4.00 CSCL 04A

Five Nike-Tomahawk rockets were flown to measure perturbations in the magnitude of the geomagnetic field due to auroral electrojets. The dates and locations of the rocket launches are given along with a brief explanation of payloads and instrumentation. Papers published as a result of the project are listed. An abstract is included which outlines the scientific results from one of the flights. A.A.D.

N74-26878*# Mississippi State Univ., State College. Inst. for Environmental Studies.

APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 Nov. 1973 - 30 Apr. 1974

C. W. Bouchillon, W. F. Miller, H. Landphair, and V. L. Zitta 30 Apr. 1974 20 p

(Grant NGL-25-001-054)

(NASA-CR-138618; SAPR-1) Avail: NTIS HC $4.00 CSCL 08B

The state of Mississippi is the task site for the Remote Sensing Applications Program which attempts to recognize and solve the state's environmental, resource, and socio-economic problems through inventory, analysis, and monitoring by appropriate remote sensing systems. Several specific projects are summarized according to objectives, accomplishments, and future plans. A terrain analysis workshop is outlined, and the staff and state agencies participating in the program are listed. A.A.D.

N74-26879*# Techtran Corp., Glen Burnie, Md.

USE OF LASER SOUNDING TO DETERMINE CERTAIN ATMOSPHERIC CHARACTERISTICS

V. M. Zakharov, O. K. Kostko, and V. S. Portasov Washington NASA Jun. 1974 11 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 4, Apr. 1974 p 80-85

(Contract NASw-2485)

(NASA-TT-F-15692) Avail: NTIS HC $4.00 CSCL 04A

Experimental results of atmospheric sounding by laser locator at wavelengths of 694.3 and 1,060 nm are presented. Total reverse dispersion profiles were obtained; the sounding data at nacreous cloud altitude compares favorably with other LIDAR measurements. Data was processed from dual-frequency sounding for signal distribution, determined by reverse molecular and aerosol dispersion. Atmospheric density is computed by reverse molecular dispersion. Author

N74-26880# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 3, 1974
22 May 1974 176 p refs Transl. into ENGLISH of Meteorol. Gidrol. (Moscow), no. 3, 1974
(JPRS-62052) Avail: NTIS HC $12.00

Articles on microclimate, agricultural meteorology, weather forecasting and climate control, hydrological forecasting, the activities and personnel of the Soviet Hydrometeorological Service, and new publications are presented. Some of the subjects discussed are: (1) environmental changes as a result of industrial activity, (2) long range weather forecasting methods, (3) chemical pollution of the North Atlantic Ocean, (4) distribution of water flows and mean current velocities through the length of a reservoir, and (5) formation and forecasting of low altitude clouds. For individual titles, see N74-26881 through N74-26898.

N74-26881 Joint Publications Research Service, Arlington, Va.
THE 125TH ANNIVERSARY OF THE MAIN GEOPHYSICAL OBSERVATORY IM. A. I. VOYEYKOV c11
Ye. P. Borisenkov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 1-7 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3 1974 p 3-8 (For availability see N74-26880 16-13)

The history of the development of the Main Geophysical Observatory in the Soviet Union is discussed. The organization of meteorological and magnetic observations prior to and following the establishment of the laboratory are identified. The actions of the Soviet Government in approving and financing the laboratory are explained. Important fields of research presently conducted by the laboratory are reported. Author

N74-26882 Joint Publications Research Service, Arlington, Va.
ENVIRONMENTAL CHANGES AS A RESULT OF INDUSTRIAL ACTIVITY
A. M. Ryabchikov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 8-17 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 9-16 (For availability see N74-26880 16-13)

The global and regional changes of the environment under the influence of industrial activity are described. The problem of paying negative cost of production is analyzed. The problem of maintaining natural equilibrium in the biosphere and restoration and protection of the environment are examined. The six energy factors which determine the equilibrium of the biosphere are indentified. The adverse effects of industry on the quality of air and water is emphasized. Author

N74-26883 Joint Publications Research Service, Arlington, Va.
LONG RANGE WEATHER FORECASTING METHODS BASED ON THE SOLUTION OF BASIC AND CONJUGATE PROBLEMS c20
G. I. Marchuk *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 18-38 ref Transl. into ENGLISH from Meteorol. Gidrol. (Moscow) no. 3, 1974 p 17-34 (For availability see N74-26880 16-13)

This work is a continuation of the article Basic and Conjugate Equations of Atmospheric and Oceanic Dynamics. The use of conjugate equations for solving problems of long range weather forecasting is examined. A variation of functionals of problems (average temperature anomaly, average vertical anomalies of currents for large regions of the earth) is constructed. Equations are derived for the stated anomalies on the basis of the input data of problems for atmospheric and oceanic dynamics, and also for the thermal conductivity of the continents. Author

N74-26884 Joint Publications Research Service, Arlington, Va.
ON THE PREDICTION OF SEVERE WEATHER c20
A. N. Bagrov, V. N. Vapnik, and A. I. Snitkovskiy *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 39-50 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 35-43 (For availability see N74-26880 16-13)

The application of pattern (generalized picture) recognition methods for the solution of the problem of forecasting dangerous weather phenomena, such as squalls and ice glazing, is examined. The solving rules that are derived are shown to have rather high validity. Author

N74-26885 Joint Publications Research Service, Arlington, Va.
COMPARISON OF METEOROLOGICAL ELEMENTS IN THE UPPER ATMOSPHERE OF THE ARCTIC AND ANTARCTIC
Yu. P. Koselkov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 51-57 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no 3, 1974 p 44-49 (For availability see N74-26880 16-13)

Features of the seasonal curve of temperature, pressure and density at altitudes of 30-80 km are found in the Antarctic in comparison with the Arctic on the basis of rocket sounding data. Great differences have been found to last in these parameters up to 80 km in both hemispheres, which must be taken into consideration in the construction of referenced models of the atmosphere. Author

N74-26886 Joint Publications Research Service, Arlington, Va.
ICING RATE OF SMALL DISPLACEMENT FISHING BOATS UNDER VARIOUS HYDROMETEOROLOGICAL CONDITIONS
L. G. Kachurin, L. I. Gashin, and I. A. Smirnov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 58-71 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 50-60 (For availability see N74-26880 16-13)

The solution of the problem of the rate of icing of a cylindrical rod under conditions similar to the spray icing of small displacement fishing boats is developed. The basic solution takes into consideration the temperature of the air and water, wind velocity, wave height and salinity of the water. A nomogram is constructed for operational determination of the rate of icing of small displacement fishing boats under various hydrometeorological conditions. Author

N74-26887 Joint Publications Research Service, Arlington, Va.
THE PRESENT STATE OF CHEMICAL POLLUTION OF THE NORTH ATLANTIC
A. I. Simonov, S. G. Oradovskiy, and A. A. Yushchak *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 72-82 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 61-69 (For availability see N74-26880 16-13)

Data on the concentration of oil, mercury, detergents and pesticides in the North Atlantic Ocean are presented. The role of circulation in the spreading of pollutants is assessed. Author

N74-26888 Joint Publications Research Service, Arlington, Va.
NUMERICAL MODEL AND CALCULATION OF BLACK SEA CURRENTS
A. S. Sarkisyan and T. Z. Dzhioyev *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 83-91 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 70-76 (For availability see N74-26880 16-13)

The results of calculation of currents in the Black Sea on the basis of the density field and atmospheric pressure at sea level, determined from observations, through the smooth surface and the total flow function, are presented in the article. A comparative characterization of the results is presented. The data are presented in the form of maps of level surface topography, complete flow function and maps of velocity vectors on various horizons. Author

N74-26889 Joint Publications Research Service, Arlington, Va.
CALCULATION OF THE DISTRIBUTION OF WATER FLOWS AND MEAN CURRENT VELOCITIES THROUGH THE LENGTH OF A RESERVOIR
G. A. Urlapov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 92-97 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 77-81 (For availability see N74-26880 16-13)

The relation between the basic hydrological parameters of flow and the morphological characteristics of a reservoir with one current is established. The feasibility of practical utilization of the established principle for determining water flow rate and mean velocity in the headrace canal is illustrated by way of a numerical example. The graphic solution of the problem is presented for simplifying and speeding up the determination of the desired values. Author

N74-26890 Joint Publications Research Service, Arlington, Va.
THE MECHANISM OF SILT FLOW FORMATION AND CALCULATION OF SOLID PHASE CONCENTRATION
V. I. Yefremov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 18-106 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 82-88 (For availability see N74-26880 16-13)

The mechanism of silt flow formation is analyzed on the basis of its dynamic suspendability. A theoretical method is developed for calculating the solid phase concentration and the calculated volume weights of silt flows are compared with measurement data. Author

N74-26891 Joint Publications Research Service, Arlington, Va.
NONSTATIONARY MODEL OF WATER-HEAT REGIME OF VEGETATION COVER c04
O. D. Sirotenko *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 107-118 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 89-97 (For availability see N74-26880 16-13)

A theoretical method of calculating the heat and water regime of crops, based on the solution of nonstationary equations of turbulent thermal conducitivity, turbulent vapor diffusion in the space between leaves, thermal balance of surface phytomass, and also nonstationary quasilinear equations of moisture transfer and soil thermal conductivity, is suggested. The water balance relation of plants is used for closing the equation system. Author

N74-26892 Joint Publications Research Service, Arlington, Va.
BRIEF REPORTS ON THE TIME STATISTICAL STRUCTURE OF GROUND-LEVEL AIR PRESSURE
L. A. Minakova *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 119-122 ref Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 98-100 (For availability see N74-26880 16-13)

Information is presented on the time correlation function of the ground-level air pressure of the Northern Hemisphere during the cold half of the year. Calculations were performed for 130 stations of the Northern Hemisphere (above 40 degrees north latitude). Daily observation data of atmospheric pressure for the four cold periods of 1956 through 1960 are used for the analysis. A mathematical model of the standard time correlation function is provided. Author

N74-26893 Joint Publications Research Service, Arlington, Va.
CALCULATION OF THE TRANSPORT RATE OF BARIC FORMATIONS THROUGH THE ISALLOBAR FIELD c20
F. T. Doroshenko *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 123-125 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 100-102 (For availability see N74-26880 16-13)

A simple method of determining the approximate transport rate of baric formations, which takes into consideration data on the barometric trends and depth of cyclonic formations is presented. Experience shows that deep cyclones and strong anticyclones occupy vast spaces, and therefore the phase and amplitude characteristics of such perturbations are connected by a certain relationship. With this fact in mind it is possible for approximate calculations to use approximate equations, based on utilization of data on baric trends and values that take into consideration the amplitude of the baric formation. Many such methods, which lost their significance after the appearance and adoption of the computer. In certain cases, however, when the fields of trends are quite distinct and it is impossible to use calculation data in the computer, it is possible to solve problems by an approximate equation. Author

N74-26894 Joint Publications Research Service, Arlington, Va.
CONTROVERSIAL ISSUES ON THE PRACTICAL IMPORTANCE OF SUN-TROPOSPHERE PROBLEM
V. A. Krat and B. M. Rubashev *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 126-130 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 103-105 (For availability see N74-26880 16-13)

The feasibility of using solar activity as a basis for weather forecasting is discussed. The fundamental relationships between solar flares and the weather are examined. The differences of opinion among meteorologist on the effects of the sun on weather are examined. Author

N74-26895 Joint Publications Research Service, Arlington, Va.
INSTRUMENTS, OBSERVATIONS AND PROCESSING HYDROLOGICAL PROCESSES AND THE PROBLEM OF THE NETWORK OF AUTOMATIC BUOY STATIONS IN THE OCEAN
V. F. Sukhovey and A. G. Sukhoven *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 131-139 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 106-110 (For availability see N74-26880 16-13)

Problems of the optimum placement of oceanographic buoy stations and frequency of measurements in time are examined on the basis of analysis of the space and time structure of the fields of the temperature and salinity of the Atlantic Ocean water. It is shown that measurements at stations, conducted from 4 to 8 times a day, are sufficient for analyzing hydrological macroprocesses. As regards the distances between buoy stations, they should not be more than 200-230 km apart in regions of greatest anomalies of hydrological elements (frontal zones). They may be separated by up to 400-500 km in the central and tropical parts of the Atlantic Ocean. Author

N74-26896 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL INVESTIGATIONS OF SIGNAL POLARIZATION CHARACTERISTICS DURING SCATTERING OF RADIO WAVES BY ATMOSPHERIC PARTICLES IN DIVERSE RECEIVING MODE
R. P. Tychina, K. G. Tskhakaya, and A. B. Shupyatskiy *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 140-149 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 111-116 (For availability see N74-26880 16-13)

The polarization characteristics of the signal from clouds and precipitation for various angles of diversity are investigated experimentally. The results of measurement of the polarization characteristics of signals for various types of clouds and precipitations in the bistatic mode are presented. Author

N74-26897 Joint Publications Research Service, Arlington, Va.
REVIEW AND BIBLIOGRAPHY CONDITIONS OF FORMATION AND FORECASTING OF LOW-ALTITUDE CLOUDS c20
A. M. Baranov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 150-153 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 117-118 (For availability see N74-26880 16-13)

The structure of the lower boundary of clouds and the variability of this boundary in time and space are discussed. Data on the comparability of altitudes of clouds, measured from airplanes and by various methods from the ground, are presented. Investigations of the conditions of formation of low level stratus clouds were conducted and the results are summarized. The fundamental principles and methods of forecasting low altitude clouds are explained. Author

N74-26898 Joint Publications Research Service, Arlington, Va.
AN UNUSUAL CYCLONE c20
S. V. Chelyukanova *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 165-167 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 123-124 (For availability see N74-26880 16-13)

A cyclone of unusual depth passed on 25-26 November 1973 from the Atlantic Ocean to the Baltic and central regions of the European territory of the Soviet Union. This cyclone traveled at a speed of 70 km/hr. The jet stream, in the central part of which the wind velocity reached 60-66 m/s, passed over England, Denmark and the southern Baltics, and then on to Moscow. Of the photographs that were taken from weather satellites the most interesting in terms of forecasting was the one taken on the morning of 24 November. During that time the cyclone was located over northern England. The photograph quite clearly showed the cloud bands of two frontal systems of arctic and polar fronts with a broad thermal spectrum. Two warm fronts were clearly pronounced in the cloud cover, in which bands (offshoots) of cirrus clouds were visible. Author

N74-26899*# Michigan Univ., Ann Arbor. Infrared and Optics Lab.
POST-ANALYSIS REPORT ON CHESAPEAKE BAY DATA PROCESSING Informal Final Report
F. Thomson Apr. 1972 49 p refs
(Contract NAS6-2058)
(NASA-CR-137461; WRL-10653-4-F) Avail: NTIS HC $5.50 CSCL 05B

The additional processing performed on data collected over the Rhode River Test Site and Forestry Site in November 1970 is reported. The techniques and procedures used to obtain the processed results are described. Thermal data collected over three approximately parallel lines of the site were contoured, and the results color coded, for the purpose of delineating important scene constituents and to identify trees attacked by pine bark beetles. Contouring work and histogram preparation are reviewed and the important conclusions from the spectral analysis and recognition computer (SPARC) signature extension work are summarized. The SPARC setup and processing records are presented and recommendations are made for future data collection over the site. A.A.D.

N74-26900# Joint Publications Research Service, Arlington, Va.
GEOLOGICAL STRUCTURE AND OIL AND GAS IN THE ARCTIC
B. A. Sokolov, A. G. Gaynanov, D. V. Nesmeyanov, and A. M. Seregin 28 May 1974 27 p refs Transl. into ENGLISH from the book "Neftegazonosnost Morey i Okeanov" USSR, Nedra Press, 1973 p 194-217
(JPRS-62095) Avail: NTIS HC $4.50

A discussion of the geological structure as it relates to oil and gas in the Arctic is presented. Author

N74-26901# Joint Publications Research Service, Arlington, Va.
METHODOLOGICAL PLAN FOR AERIAL SEISMIC STUDIES AT SEA AND IN THE OPEN OCEAN
S. V. Potapyev, G. G. Beletskiy, and I. I. Levin 23 May 1974 11 p refs Transl. into ENGLISH from Geol. Geofiz. (USSR), no. 11, 1973 p 102-107
(JPRS-62075) Avail: NTIS HC $4.00 CSCL 08C

A plan for aerial observations by the registry of oscillations by means of marine telemetric autonomous radio buoys outfitted with aircraft guidance and detection instrumentation is presented. Author

N74-26902# Environmental Protection Agency, Research Triangle Park, N.C.
UTILIZATION OF RESOURCES AND PROTECTION OF THE ENVIRONMENT IN HIGH DENSITY AREA: FINDINGS AND RECOMMENDATIONS BASED ON STUDY OF THE LOWER ATMOSPHERE AND TERRAIN VEGETATION IN THE SOUTH KANTO PLAIN
[1973] 44 p refs Prepared by Sci. and Technol. Agency, Tokyo
(APTIC-41535) Avail: NTIS HC $5.25

Contamination of the atmosphere and the environment was studied to correlate damage to trees with pollution resistance levels in man. The correlation is then applied to develop standards for dealing with problems in pollution control, regional planning, and in the selection of industrial and residential land use criteria. Maps, charts, and photographs are included. A.A.D.

N74-26903*# Pittsburgh Univ., Pa. Space Research Coordination Center.
LABORATORY STUDIES ON THE EXCITATION AND COLLISIONAL DEACTIVATION OF METASTABLE ATOMS AND MOLECULES IN THE AURORA AND AIRGLOW
Edward C. Zipf Feb. 1974 32 p refs
(Grant NGL-39-011-030)
(NASA-CR-138614) Avail: NTIS HC $4.75 CSCL 04A

The aeronomy group at the University of Pittsburgh is actively engaged in a series of coordinated satellite, sounding rocket, and laboratory studies designed to expand and clarify knowledge of the physics and chemistry of planetary atmospheres. Three major discoveries have been made that will lead ultimately to a complete and dramatic revision of our ideas on the ionospheres of Mars, Venus, and the Earth and on the origin of their vacuum ultraviolet airglows. The results have already suggested a new generation of ionosphere studies which probably can be carried out best by laser heterodyning techniques. Laboratory studies have also identified, for the first time, the physical mechanism responsible for the remarkable nitric oxide buildup observed in some auroral arcs. This development is an important break-through in auroral physics, and has military ramifications of considerable interest to the Department of Defense. This work may also shed some light on related NO and atomic nitrogen problems in the mesosphere. Author

N74-26904*# Michigan Univ., Ann Arbor.
THERMAL CONTOURING OF FORESTRY DATA: WALLOPS ISLAND
Fred Thomson 13 Mar. 1972 12 p
(Contract NAS6-2058)
(NASA-CR-137459; Rept-010653-2-L) Avail: NTIS HC $4.00 CSCL 02F

The contouring of 8-13.5 micrometer thermal data collected over a forestry site in Virginia is described. The data were collected at an altitude of 1000 ft above terrain on November 4, 1970. The site was covered on three approximately parallel lines. The purpose of the contouring was to attempt to delineate pine trees attacked by southern pine bark beetle, and to map other important terrain categories. Special processing steps were required to achieve the correct aspect ratio of the thermal data. The reference for the correction procedure was color infrared photography. Data form and quality are given, processing steps are outlined, a brief interpretation of results is given, and conclusion are presented. Author

N74-26905*# Florida Inst. of Tech., Melbourne.
AN ECOLOGICAL STUDY OF THE KSC TURNING BASIN AND ADJACENT WATERS
T. A. Nevin, J. A. Lasater, K. B. Clark, and E. H. Kalajian 15 Jan. 1974 37 p
(Grant NGR-10-015-008)
(NASA-CR-138675; Rept-6) Avail: NTIS HC $5.00 CSCL 08A

The conditions existing in the waters and bottoms of the Turning Basin, the borrow pit near Pad 39A, and the Barge Canal connecting them were investigated to determine the ecological significance of the chemical, biological, and microbiological parameters. The water quality, biological, microbiological findings are discussed. It is recommended that future dredging activities be limited in depth, and that fill materials should not be removed down to the clay strata. F.O.S.

N74-26906*# Alaska Univ., College.
AN AEROMAGNETIC SURVEY IN THE VALLEY OF TEN THOUSAND SMOKES, ALASKA M.S. Thesis
Kei Anma Nov. 1971 107 p refs
(Grants NGR-02-001-063; NSF GA-12014)
(NASA-CR-138729) Avail: NTIS HC $8.50 CSCL 08N

Geologic and magnetic studies of the Katmai area have further demonstrated the close relationship between the Katmai Caldera, Novarupta plug, and the pyroclastic flows in the Valley of Ten Thousand Smokes. The magnetic fields observed appear to be associated with the thickness of the pyroclastic flow and the different rock units within it for lower flight levels, and also the contrast between the valley fill and the rock units at the Valley margins. Consistent magnetic anomalies are associated with the larger fumarole lines, which were presumably sites of large scale activity, while the smaller fumaroles are not usually seen in the aeromagnetic map. A possible correlation between low positive anomalies and nuee ardente deposits was revealed by the aeromagnetic survey, but was not strong. A ground survey was also carried out in several parts of the Valley with a view to detailed delineation of the magnetic signatures of the pyroclastic flow, as an aid to interpreting the aeromagnetic date. Author

N74-26907*# Alaska Univ., College.
GROUND MAGNETOMETER SURVEY IN THE VALLEY OF TEN THOUSAND SMOKES, ALASKA M.S. Thesis
Marla Cave Trible May 1972 210 p refs
(Grant NGL-02-001-063)

(NASA-CR-138779) Avail: NTIS HC $13.50

A reconnaissance magnetometer survey was conducted with both total- and vertical-field magnetometers. The large, sharp, narrow total magnetic anomalies observed over a zone of relict fumaroles in Broken Mountain Valley showed spectacular agreement with the surficial geology. Such a correlation is a strong indication that accumulations of magnetic minerals have been preserved along these fissure vents at shallow depths. Since large magnetic anomalies were measured near fumarolic markings along all of the traverses, it is proposed that the retention of sublimates along fumarolic vents is common throughout the Valley. The generally concentric contours of the vertical magnetic anomaly at the head of the Valley suggest that the dome of Novarupta is merely the surficial expression of a very massive conical-shaped intrusive centered just northeast of the dome. The magnetometer survey indicates that the pyroclastics in the Valley may be over 150 meters thick. Such an estimate is compatible with the volume of eruptive material needed to compensate for the subsidence surrounding Novarupta as well as a sizable amount of other regional subsidence. Author

N74-26908# National Science Foundation, Washington, D.C. Office for the international Decade of Ocean Exploration.

INTERNATIONAL DECADE OF OCEAN EXPLORATION: PROGRAM DESCRIPTION

Oct. 1973 62 p refs

(Rept-2) Avail: NTIS HC $6.25

History and evolution of the nature and extend of oceanographic research are recalled. Topics range from undersea telegraphy to industrial fishing and economic activities of man ashore. Emphasis is placed on environmental quality and forecasting, seabed assessment, and ocean resources management. G.G.

N74-26909*# Indiana Univ., Bloomington.

MOLECULAR COLUMN DENSITIES IN SELECTED MODEL ATMOSPHERES

Hollis R. Johnson, Reta F. Beebe (New Mexico State Univ.), and Christopher Sneden 28 Jun. 1974 30 p refs

(Grant NGL-15-003-002)

(NASA-CR-138771) Avail: NTIS HC $4.50 CSCL 04A

From an examination of predicted column densities, the following conclusions were drawn: (1) The SiO ought to be visible in 'carbon stars which were generated from triple alpha burning, but absent from carbon stars generated from the CNO bi-cycle. (2) Variation in the observed relative strengths of TiO and ZrO is indicative of real differences in the ratio Ti/Zr. (3) The TiO/ZrO ratio shows a small variation as C/O and effective temperature is changed. (4) Column density of silicon dicarbide (SiC2) is sensitive to abundance, temperature, and gravity; hence all relationships between the strength of SiC2 and other stellar parameters will show appreciable scatter. There is however, a substantial luminosity effect present in the SiC2 column densities. (5) Unexpectedly, SiC2 is anti-correlated with C2. (6) The presence of SiC2 in a carbon star eliminates the possibility of these stars having temperatures greater than or equal to 3000 K, or being produced through the CNO bi-cycle. Author

N74-26910*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.

REMOTE SENSING AS AN AID TO ROUTE EVALUATION FOR RELOCATED LOUISIANA HIGHWAY 1

Robert L. Thoms, Charles A. Whitehurst, and Judith Monte, A. Mar. 1974 35 p refs

(Grants NGL-19-001-097; NGL-19-001-024)

(NASA-CR-138770; DER-RM-1) Avail: NTIS HC $4.75 CSCL 08B

NASA aerial photography in the form of color infrared and color positive transparencies is used as an aid for evaluation of the route proposed for relocated Louisiana Highway 1, between LaRose and Golden Meadow, in South Louisiana. Author

N74-26911*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.

SEDIMENT TRANSPORT AND EROSION IN THE FOURCHON AREA OF LAFOURCHE PARISH

Charles A. Whitehurst and R. P. Self (Nicholls State Univ., Thibodaux, Louisiana) May 1974 28 p refs

(Grants NGL-19-001-097; NGL-19-001-024)

(NASA-CR-138776; DER-RM-3) Avail: NTIS HC $4.50 CSCL 08H

NASA aerial photography in the form of color infrared and color positive transparencies is used as an aid in evaluating the rate and effect of erosion and sediment transport in Bay Champagne Louisiana. Author

N74-26912*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.

REMOTE SENSING AS AN AID FOR MARSH MANAGEMENT: LAFOUCHE PARISH, LOUISIANA

James G. Ragan (Nicholls State Univ., Thibodaux, Louisiana), John H. Green (Nicholls State Univ., Thibodaux, Louisiana), and C. A. Whitehurst May 1974 30 p refs

(Grants NGL-19-001-097; NGL-19-001-024)

(NASA-CR-138775; DER-RM-2) Avail: NTIS HC $4.50 CSCL 08H

NASA aerial photography, primarily color infrared and color positive transparencies, was used in a study of marsh management practices and in comparing managed and unmanaged marsh areas. Weir locations for tidal control are recommended. Author

N74-26913# National Oceanic and Atmospheric Administration, Boulder, Colo.

STD OBSERVATIONS IN THE NORTHEAST PACIFIC, SEPTEMBER - OCTOBER 1972

Ronald K. Reed and David Halpern May 1973 62 p refs

(NOAA-TR-ERL-271-POL-19) Avail: SOD HC $0.95

Summaries of STD measurements in the northeast Pacific during September and October 1972 are presented as computer generated plots and as listings of temperature, salinity, sigma-t, and dynamic height anomaly. Distributions of physical properties and flow during October are presented and discussed. The variation of dynamic height anomaly at three time series stations is evaluated; results at all sites suggest the existence of semidiurnal internal tidal waves. Deviations at the same sites occupied a month apart were only slightly greater than those that occurred during a 12-hr period. Author

N74-26914# Environmental Protection Agency, Washington, D.C.

STRATEGIC ENVIRONMENTAL ASSESSMENT SYSTEM (SEAS): A RESEARCH PROJECT

Stanley M. Greenfield May 1973 72 p Presented at the Natl. Conf. on Managing the Environ., Washington, D. C., 14-15 May 1973

Avail: NTIS HC $6.75

The concept of long range, comprehensive environmental planning is presented in a report of SEAS current activities and goals. The need for strategic assessment and what it involves in terms of man-machine capabilities is described. The SEAS development program is outlined, and project objectives, system components, and policy making applications are discussed. A.A.D.

N74-26915*# Alaska Univ., College.

PALEOMAGNETISM OF THE MESOZOIC IN ALASKA Ph.D. Thesis

Dwane R. Packer May 1972 170 p refs

(Grants NGL-02-001-063; NSF GA-1216; NSF GA-12014)

(NASA-CR-138746) Avail: NTIS HC $11.50 CSCL 08N

Over 400 oriented cores of Permian, Triassic, Jurassic, and Cretaceous sedimentary and igneous rocks were collected from 34 sites at 10 areas throughout southern Alaska. After magnetic cleaning in successively higher alternating fields 179 samples were considered to be stable and to give statistically consistent results within each site and age group. Due to the lack of a sufficient number of stable samples, the results from Permian, Triassic, and Cretaceous rocks were inconclusive. The nine remaining Jurassic sites represent 100 samples from three general areas in southern Alaska. The southern Alaskan Jurassic paleomagnetic pole is significantly different from the North American Jurassic pole. This suggests that since the Jurassic, southern Alaska must have moved approximately 18 degrees north and rotated 52 degrees clockwise to reach its present position. Tectonic interpretation of these results give a possible

explanation for many of the geologic features observed in southern Alaska. Author

N74-26916# Ohio State Univ. Research Foundation, Columbus. Dept. of Physics.
THE EFFECTS OF REFRACTION AND DISPERSION ON HIGH-ALTITUDE MEASUREMENTS OF ATMOSPHERIC GASES Interim Report
James K. G. Watson and Peter K. L. Yin Oct. 1973 104 p refs
(Grant NOAA-NG-28-72; RF Proj. 3460)
Avail: NTIS HC $8.25

The theories of atmospheric refraction and anomalous dispersion are studied for the purpose of assisting the interpretation of measurements of atmospheric gases by the solar occultation technique, and a computer program has been written to calculate a theoretical occultation spectrum in the vicinity of an isolated absorption line. A brief general discussion of the pertinent physical parameters, such as refractive index, line intensities and line shapes, is included. The theory is applied to several infrared absorption lines of water vapor, particularly the 1404.988 cm line, assuming a pure Lorentz line shape. This assumed line shape is only valid for altitudes below about 20 km. Author

N74-26917# Earth Satellite Corp., Washington, D.C.
THE POTENTIAL OF METEOROLOGICAL SATELLITE CLOUD OBSERVATIONS FOR DELINEATION OF SIGNIFICANT FEATURES OF COASTAL UPWELLING OFF OREGON Final Report
Jack M. Meneely and Earl S. Merritt Mar. 1973 105 p refs
(Contract NOAA-2-35462)
Avail: NTIS HC $8.25

The relationship between the occurrence of upwelling of subsurface water along the central Oregon coast and satellite-observed cloud patterns was examined for the summers of 1971 and 1972. Data used for both years included daily ESSA-9 coverage and hourly wind data from a recording anemometer on the south jetty at Newport, Oregon. Examination of the wind data revealed that 1972 was a much more active upwelling year than 1971. A set of criteria was established to define the beginning and end of an upwelling event based on the wind observations. Sea-surface temperature distributions were compared with observed cloud patterns for a major upwelling event in late August 1972. The onset, existence, and cessation of upwelling were found to relate to several recognizable cloud situations and it was concluded that satellite imagery can provide a basic tool for monitoring upwelling off Oregon. Author

N74-26918*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVIMETRIC GEODESY AND SEA SURFACE TOPOGRAPHY STUDIES BY MEANS OF SATELLITE-TO-SATELLITE TRACKING AND SATELLITE ALTIMETRY
Joseph W. Siry Aug. 1972 143 p refs Presented at the 9th Intern. Symp. on Geophys. Theory and Computers, Banff, Canada, Aug. 1972; sponsored by the Comm. for Math. Geophys. of the Intern. Union of Geodesy and Geophys.
(NASA-TM-X-70670; X-590-73-251) Avail: NTIS HC $10.25 CSCL 08E

A satellite-to-satellite tracking experiment is planned between ATS-F and GEOS-C with a range accuracy of 2-meters and a range rate accuracy of 0.035 centimeters per second for a 10-second integration time. This experiment is planned for 1974. It is anticipated that it will improve the spatial resolution of the satellite geoid by half an order of magnitude to about 6 degrees. Longer integration times should also permit a modest increase in the acceleration resolution. Satellite altimeter data will also be obtained by means of GEOS-C. An overall accuracy of 5-meters in altitude is the goal. The altimeter, per se, is expected to have an instrumental precision of about 2 meters, and an additional capability to observe with a precision of about 0.2 meters for limited periods. Author

N74-26919*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ION EFFECTS ON IONOSPHERIC ELECTRON RESONANCE PHENOMENA
Robert F. Benson May 1974 33 p refs Submitted for publication
(NASA-TM-X-70675; X-621-74-138) Avail: NTIS HC $4.75 CSCL 03B

Ion effects are often observed on topside-sounder stimulated electron plasma wave phenomena. A commonly observed effect is a spur, appearing after a time delay corresponding to the proton gyro period, attached to the low frequency side of an electron plasma resonance. The spurs are often observed on the resonances at the electron plasma frequency f sub N, the harmonics nf sub H of the electron cyclotron frequency f sub H (n = 2, 3, 4, ...), and occasionally on the upper hybrid frequency. The spurs on the f sub N resonance are usually quite small unless the f sub N resonance overlaps with an nf sub H resonance; very large spurs are observed during such overlap conditions. Proton spurs are only observed on the nf sub H resonances when the electron plasma waves associated with these resonances are susceptible to the Harris instability and when the electromagnetic z wave can be initiated by the sounderpulse. This instability is the result of a sounder stimulated anisotropic electron velocity distribution. The observations suggest that energy is fed into the nf sub H longitudinal plasma wave from the z wave via wave-mode coupling. The magnitude of the nf sub H spurs for large n is much greater than for small n. Author

N74-26920*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR SYMMETRIC FLOW OF A VISCOUS COMPRESSIBLE ATMOSPHERE: AN APPLICATION TO MARS
Joseph A. Pirraglia May 1974 43 p refs Submitted for publication
(NASA-TM-X-70672; X-622-74-124) Avail: NTIS HC $5.25

The atmosphere is assumed to be driven by a polar symmetric temperature field and the equations of motion in pressure ratio coordinates are linearized by considering the zero order in terms of a thermal Rossby number R delta T/(2a omega) sq where delta T is a measure of the latitudinal temperature gradient. When the eddy viscosity is greater than 1 million sq cm/sec, the boundary layer extends far up into the atmosphere, making the geostrophic approximation invalid for the bulk of the atmosphere. A temperature model for Mars was used which was based on Mariner 9 infrared spectral data with a 30% increase in the depth averaged temperature from the winter pole to the subsolar point. The results obtained for the increase in surface pressure from the subsolar point to the winter pole, as a function of eddy viscosity and with no-slip conditions imposed at the surface, are given. Author

N74-26921# Committee for Hydrological Research TNO, the Hague (Netherlands).
HYDRAULIC RESEARCH FOR WATER MANAGEMENT
1973 144 p refs Proc. of the 26th Tech. Meeting, 28 Oct. 1971
(Proc-Inform-18) Avail: NTIS HC $10.25

The use of mathematical models in hydraulics research is discussed. Polder reservoir control and hydraulics of open water management is considered. Computational methods for channel flow were derived. Transport of pollutants or heat in a system of channels is detailed and practical applications of computation for channel networks are given. For individual titles, see N74-26922 through N74-26926.

N74-26922 Rijnland Water Board, Leiden (Netherlands).
PROBLEMS FACING THE POLDER RESERVOIR CONTROL
H. DeGroot *In* Comm. for Hydrol. Res. TNO Hydraulic Res. for Water Management 1973 p 11-19 (For availability see N74-26921 16-13)

Water reservoir control of the polders of the Netherlands is discussed. The functioning of the network of reservoir waters and the practice of reservoir control are considered. Quantitative and qualitative aspects are outlined, and the problems connected with the actual tasks of the reservoir controller are detailed.
ESRO

N74-26923 Waterloopkundig Laboratorium, Delft (Netherlands).
HYDRAULICS OF OPEN-WATER MANAGEMENT
E. Allersma *In* Comm. for Hydrol. Res. TNO Hydraulic Res. for Water Management 1973 p 20-37 (For availability see N74-26921 16-13)

Basic hydraulic aspects of the behavior of water in open water courses, sewers, lakes, and control structures are surveyed. The phenomena involved in the transportation of matter (pollutants, sediments, salt) and heat by water are discussed. ESRO

N74-26924 Waterloopkundig Laboratorium, Delft (Netherlands).
COMPUTATIONAL METHODS FOR CHANNEL FLOW
C. B. Vreugdenhil *In* Comm. for Hydrol. Res. TNO Hydraulic Res. for Water Management 1973 p 38-79 refs (For availability see N74-26921 16-13)

Methods for calculation of both steady and unsteady flow of water in water courses were developed. Facilities, difference equations, and numerical effects for unsteady flows are discussed. Facilities, convergence, and optimal meshes for steady flows are considered. ESRO

N74-26925 Waterloopkundig Laboratorium, Delft (Netherlands).
TRANSPORT OF POLLUTANTS OR HEAT IN A SYSTEM OF CHANNELS c12
J. C. W. Berkhoff *In* Comm. for Hydrol. Res. TNO Hydraulic Res. for Water Management 1973 p 80-106 refs (For availability see N74-26921 16-13)

The transport of contaminants in a system of channels was treated mathematically. The derivation, validity, and boundary conditions of the one-dimensional dispersion equation, the dispersion coefficient, and numerical methods for solving steady or unsteady state equations are discussed. The magnitude of the longitudinal dispersion coefficient was estimated. ESRO

N74-26926 Waterloopkundig Laboratorium, Delft (Netherlands).
PRACTICAL APPLICATIONS OF COMPUTATIONS FOR CHANNEL NETWORKS c12
C. Veeningen *In* Comm. for Hydrol. Res. TNO Hydraulic Res. for Water Management 1973 p 107-140 ref (For availability see N74-26921 16-13)

The application of network computation to water management problems is illustrated with examples, including floods in creeks and rivers, tidal movements in estuaries and rivers, sewage systems, coupling of open channel flow, and ground water movement. A mathematical model of an open channel network is discussed. ESRO

N74-26927# Freie Univ., Berlin (West Germany). Inst. fuer Geophysik.
GEOPHYSICAL DATA, NO. 3: MODULATION OF THE GEOMAGNETIC ACTIVITY [GEOPHYSIKALISCHE ABHANDLUNGEN, HEFT 3: ZUR MODULATION DER ERDMAGNETISCHEN AKTIVITAET]
Joachim Meyer Dietrich Reimer Verlag 1973 72 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC $6.75

A harmonic sequence analysis was carried out for 27-day and 3-day mean sequences of the daily character figures C8 from 1884 to 1968. The semiannual geomagnetic wave was confirmed to result from a terrestrial effect. A harmonic analysis of Mayaud's 3-hour indices Km yielded a 24-hour universal wave for solstitial days and a 12-hour universal wave for equinoctal days. An annual wave was detected resulting from a temporary north-south asymmetry of the solar wind within single solar sectors in connection with the same magnetospherical modulation mechanism responsible for the semiannual wave. ESRO

N74-26928# Reading Univ. (England). Dept. of Geography.
FIRST ESTIMATION OF CROP AREA STATISTICS FOR THE AREA OF ARGENTINA PHOTOGRAPHED BY SKYLARK SL 1181, USING GROUND TRUTH DATA
J. R. Hardy Jun. 1973 9 p
(Contract AT/2035/015)
(UR-RSP-1; S/AI/5E) Avail: NTIS HC $4.00

Preliminary data is given for the identification of crops by ground truth of an area in Argentina photographed from a Skylark SL 1181 rocket. It is hoped that a more detailed analysis of the photographs will enable confidence limits to be calculated. Author (ESRO)

N74-26929# Reading Univ. (England). Dept. of Geography.
PRELIMINARY ASSESSMENTS OF CROP TYPES AND LAND USE IN THE AREA OF ARGENTINA PHOTOGRAPHED BY SKYLARK EARTH RESOURCES ROCKET SL 1181, USING GROUND SURVEY DATA AND ROCKET PHOTOGRAPHY
D. S. H. Drennan Oct. 1973 11 p
(Contract AT/2035/025)
(UR-RSP-2; S/AI/14E) Avail: NTIS HC $4.00

The results of a preliminary study of crop discrimination and land use from the color photography produced by Skylark rockets over Argentina are presented. The methods involved are briefly considered and a comparison of camera systems for color balance is described. Color assessments of crops and land use categories are also discussed. Author (ESRO)

N74-26930# Reading Univ. (England). Dept. of Geography.
DELIMITATION OF THE CULTIVATED AND UNCULTIVATED AREAS OF ARGENTINA PHOTOGRAPHED BY SKYLARK SL 1181, USING ROCKET PHOTOGRAPHY
Natalia Marlenko (Comision Nacl. de Invest. Espaciales and Inst. Nacl. de Technol. Agropecuar.) Oct. 1973 6 p Sponsored in part by Brit. Council
(Contract AT/2035/025)
(UR-RSP-3; S/AI/15E) Avail: NTIS HC $4.00

Photographs taken from Skylark rockets over Argentina have enabled cultivated and uncultivated areas to be distinguished and delimited. The stages of the survey are noted and it is concluded that the boundary between the two areas can be used in the production of maps of land use. Author (ESRO)

N74-26931# Reading Univ. (England). Dept. of Geography.
THE INTERPRETATION AND USE OF FALSE-COLOUR INFRARED AND TRUE COLOUR PHOTOGRAPHY OF PART OF ARGENTINA OBTAINED BY SKYLARK EARTH RESOURCES ROCKETS
D. S. H. Drennan, J. R. Hardy, R. A. G. Savigear, and J. R. G. Townshend Oct. 1973 5 p
(Contract AT/2035/015)
(UR-RSP-4; S/AI/16E) Avail: NTIS HC $4.00

The use of color film for crop discrimination in Argentina is discussed. The photography was made from Skylark rockets using both false color infrared and true color. It was found that the false color (Kodak 2443) gave best results. Further projects such as resources mapping, land use, and communications networks mapping are under consideration. Author (ESRO)

N74-26932# Reading Univ. (England). Dept. of Geography.
PRELIMINARY RESULTS FROM SKYLARK EARTH RESOURCES ROCKET EXPERIMENT IN ARGENTINA
D. D. Clark (Dept. of Trade and Ind.), J. R. Hardy, A. J. Parsons, R. B. Ridgway, R. A. G. Savigear, and J. R. G. Townshend Jul. 1973 8 p Submitted for publication
(Contract AT/2035/015)
(UR-RSP-5; S/AI/73) Avail: NTIS HC $4.00

Preliminary results are presented from photographs of an area in Argentina taken by means of cameras carried aloft Skylark rockets. The purpose was to obtain an inventory of crops and land use and to carry out a resources survey of the central region of Argentina. The interpretation of land use, cultural features, and natural resources is discussed. Author (ESRO)

N74-26933# Reading Univ. (England). Dept. of Geography.
A REPORT ON CURRENT ACTIVITIES AND FACILITIES IN THE FIELD OF REMOTE SENSING OF EARTH RESOURCES
J. R. Hardy, comp. Jan. 1974 11 p
(UR-RSR-3; S/AI/27E) Avail: NTIS HC $4.00

Present investigations include an evaluation of photography obtained from Skylark rockets, comparison of ERTS-1 and Skylark imagery, and mapping of landforms. Future projects cover geomorphological research, soil erosion, and transport possibilities. The facilities and equipment available and planned are summarized. Author (ESRO)

N74-26934# Royal Netherlands Meteorological Inst., De Bilt.
ON THE TURBIDITY OF THE ATLANTIC OCEAN OFF THE SURINAM AND FRENCH GUYANA COAST [OVER DE TROEBELHEID VAN DE ATLANTISCHE OCEAAN VOOR DE KUST VAN SURINAME EN FRANS GUYANA]
M. P. Visser 1972 50 p refs In DUTCH; ENGLISH summary

(WR-72-7) Avail: NTIS HC $5.50

Optical oceanographic observations were carried out during autumn 1970 and spring 1971 in the southeastern part of the Caribbean and off the Surinam and French Guiana coast. If visibility depth (Secchi's disc) of a station is compared with water color according to Forel's scale a rough classification can be made into Atlantic water and continental water. Measurements of beam attenuation were also made from the surface down to depth of about 100 m. Based upon these results one can discern between coastal stations, oceanic stations, and stations with bottom influence. It turns out that beam attenuation of the surface water shows a rather good correlation to secchi depth. Author (ESRO)

N74-26935# SACLANT ASW Research Center, La Spezia (Italy).
A COMPARISON OF FORMULAE USED IN CALCULATING THE HEAT BUDGET AT THE AIR/SEA INTERFACE
David J. T. Carter 15 Jan. 1974 21 p refs
(AD-776590; SACLANTCEN-SM-37) Avail: NTIS CSCL 04/1

Different formulae have been proposed by various authors for the computation of heat-flow across the air/sea interface. Some of these formulae are examined in order to decide which ones to use for hourly heat-budget computations from meteorological observations made in the Norwegian Sea during MILOCSURV-NORLANT. A comparison of these formulae indicates the inaccuracies to be expected from computing hourly heat flow using meteorological records. Formulae are selected to compute solar altitude and to compute dew point, humidity, and vapour pressure from dry and wet bulb readings. Author (GRA)

N74-26936# Defense Mapping Agency Topographic Center, Washington, D.C.
GLOSSARY OF MAPPING, CHARTING, AND GEODETIC TERMS, THIRD EDITION
Jun. 1973 268 p refs
(AD-775778) Avail: NTIS CSCL 08/2

The terms and definitions appearing in this publication were selected from existing glossaries and dictionaries, authoritative military and civilian sources, and technical publications and papers dealing with the various disciplines that make up the fields of mapping, charting, and geodesy. For the most part, only those terms considered germane to some specific aspect of mapping, charting, and geodesy were included. In the peripheral or associated areas, such as photography, lithography, optics, mathematics, etc., only such basic terms were included as were considered necessary to establish a means of better communication between these disciplines. GRA

N74-26937# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Translation Branch.
COMPUTATION OF THE RECTANGULAR GEOCENTRIC COORDINATES OF A POINT BASED ON DISTANCES MEASURED FROM THREE REFERENCE POINTS
K. A. Laping Feb. 1974 8 p ref Transl. into ENGLISH from Geod. i Kartografiya (USSR), no. 3, 1973 p 24-25
(AD-775877; DMAAC-TC-2001) Avail: NTIS CSCL 08/2

Simple but at the same time accurate formulas are proposed for the solution of a linear space intersection. The advantage of these formulas consists in the fact that they make it possible to compute the coordinates of a certain point for any location of the reference triangle's plane relative to the equatorial plane and the plane of the Greenwich meridian without decreasing the accuracy of the resultant computations. Using computers of the M-220 type a linear space intersection according to the suggested formulas is solved in 2-3 seconds. Author (GRA)

N74-26938# Aerospace Corp., El Segundo, Calif. Lab. Operations.
UPPER ATMOSPHERIC DENSITY INFERRED FROM MAGNETRON DATA FROM THE SATELLITE 1972-32A Technical Report, Jun. 1971 - Dec. 1973
Barbara K. Ching, Judith Palmer, and Virginia L. Carter (Tandem Productions) 1 Apr. 1974 129 p refs
(Contract F04701-73-C-0074)
(AD-777574; TR-0074(4260-10)-7; SAMSO-TR-74-77) Avail: NTIS CSCL 04/1

Atmospheric densities at heights from 160 to 300 km have been inferred from magnetron gauge data obtained from the USAF satellite 1972-32A. Approximately 90 full orbits of data were obtained in the period from 21 April to 9 May 1972. Measurements were made at all latitudes between 81 degrees S and 81 degrees N at local times near noon and midnight. The instrumentation and data reduction procedure are described, and the uncertainties of the experiment are discussed. Computed densities are presented in plots as functions of both time and altitude. Author (GRA)

N74-26939# Naval Intelligence Support Center, Washington, D.C. Translation Div.
ON THE POSSIBILITY OF THE TERRESTRIAL MAGNETIC FIELD DISAPPEARING IN AN INVERSION PROCESS
N. L. Vishnevskaya and L. A. Zaschinskii 1 Nov. 1973 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), No. 10, 1972 p 145-147
(AD-777423; NISC-Trans-3464) Avail: NTIS CSCL 08/14

Various hypotheses (chiefly Frenkel's and Elsasser's earth dynamo and period of rest theories) dealing with inversion phenomena, i.e., change of sign in the terrestrial magnetic field are examined and evaluated mathematically. Calculations, consisting in the application of certain principles and consequences of the theory of characteristic surfaces to a system of wave equations, are developed that show the basic incompatibility of the two following principles, viz., (1) there is a period of rest in the inversion process, and (2) the magnetic field remains analogous to the dipole field during the inversion period. (Modified author abstract) GRA

N74-26940# McDonnell Aircraft Co., St. Louis, Mo. Reconnaissance Lab.
ARIAL DETECTION OF SPILL SOURCES
C. L. Rudder, A. G. Wallace, and C. J. Reinheimer Sep. 1973 32 p refs
(Contract EPA-01-0178)
(PB-228105/3; EPA-R2-73-289) Avail: NTIS MF $1.45; SOD HC $0.55 as EP1.23/2:73-289 CSCL 13B

An imagery interpretation key of the petroleum industry was developed for use with an aerial surveillance spill prevention system. Aerial baseline and stereogram photographs as well as aerial multiband, aerial oblique, and ground photographs of oil refineries were obtained for inclusion in the key. Processing systems to convert crude oil to fuel and LPG, gasoline, heavy fuel oils, lubricating oils and asphalt were identified with the help of military oil refinery interpretation keys. Three petrochemical facilities within the the refinery were also located and identified. The identification of potential spill sources as related to processing systems, product storage and disposition of by products and waste was performed. GRA

N74-26941# Tennessee Univ., Knoxville. Water Resources Research Center.
REMOTE SENSING IN SAMPLING SITE LOCATION IN LAKES AND STREAMS Research Report, 1 Jul. 1971 - 31 Oct. 1972
James D. Womack Jan. 1974 13 p
(Contract DI-14-31-0001-3843)
(PB-227846/3; OWRR-A-025-TENN(1)) Avail: NTIS HC $4.00 CSCL 13B

This project was intended to investigate the use of remote sensing techniques in the design of sampling programs on large lakes and streams. The wide overview of aerial photography and infrared thermal mapping scanners provide means of visualizing and measuring variations in water characteristics which might require compensation for representative sampling. Several sites on Fort Loudoun Lake were samples to determine whether persistent patterns of water quality variations existed. The parameters measured were temperature, measured with a Barnes radiometer, turbidity and color. Persistent patterns were found in the vicinity of tributary inflows and it was concluded that aerial techniques would be useful in mapping the extent and shape. (Modified author abstract) GRA

N74-26942# National Field Investigations Center, Denver, Colo.
REMOTE SENSING REPORT, SAN FRANCISCO BAY AREA, APRIL - JULY 1972. VOLUME 1
Apr. 1973 193 p
(PB-227834/9) Avail: NTIS HC $12.75 CSCL 13B

An aerial remote sensing program, requested by Region 9,

was carried out in the San Francisco Bay Area in April and July 1972. The purpose of this aerial reconnaissance program was to fulfill the following objectives: industrial wastes discharges, municipal sewage dispersion and flow patterns. GRA

N74-26943# National Field Investigations Center, Denver, Colo.
REMOTE SENSING REPORT, SAN FRANCISCO BAY AREA, APRIL - JULY 1972, VOLUME 2
Apr. 1973 209 p
(PB-227835/6) Avail: NTIS HC $13.50 CSCL 13B

A series of Geological Survey topographic maps are reported for the location of industrial wastes and sewage discharge in the San Francisco Bay Area. Also included are infrared maps on thermal fields and discharge in the Bay waters. GRA

N74-26944# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
PLASMA SPECTROSCOPY OF NEGATIVE IONS FOR APPLICATIONS TO IONOSPHERIC RESEARCH Final Report, 1 Feb. 1969 - 31 Aug. 1973
J. Cooper and J. Slater Dec. 1973 29 p refs
(Grant AF-AFOSR-74-1732-69)
(AD-776002/8; AFOSR-0303TR) Avail: NTIS HC $4.50 CSCL 07/4

An experimental investigation is made of a singlet P resonance in H(-) by means of photoabsorption spectra. The predicted resonance wavelength is 1129.5 A and a windowless vacuum UV apparatus which allows absorption studies on ionized species has been developed. Basic equipment is described. H(-) densities are generated in the afterglow of the Z-discharge through a mixture of hydrogen and cesium. The resonance was not observed, probably because of overlying 2-1 band lines of the H2 Lyman system which were more intense than originally predicted. However, the techniques developed in this work represent a significant contribution in that they for the first time allow time resolved absorption spectra on ionized species. (Modified author abstract) GRA

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-26945* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVICE FOR MONITORING A CHANGE IN MASS IN VARYING GRAVIMETRIC ENVIRONMENTS Patent
Joseph P. Valinsky, inventor (to NASA) (McDonnell-Douglas Corp., Huntington Beach, Calif.) Issued 28 May 1974 5 p Filed 13 Mar. 1973 Sponsored by NASA
(NASA-Case-MFS-21556-1; US-Patent-3,812,924; US-Patent-Appl-SN-340791; US-Patent-Class-177-200; US-Patent-Class-177-211; US-Patent-Class-177-246; US-Patent-Class-73-141A) Avail: US Patent Office CSCL 14B

A remotely operable device for detecting changes as they occur in the mass of a selected specimen is described. The device is characterized by a balance beam including at one end a support for receiving a specimen having a changing mass and suspension means, including a flexure, supporting the beam near its center of gravity for pivotal movement proportional to changes occurring in the mass of the specimen. Strain gages coupled with the flexure provide a read-out indicative of the pivotal movement imparted to the beam.
Official Gazette of the U.S. Patent Office

N74-26946* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HOLOGRAPHY UTILIZING SURFACE PLASMON RESONANCES Patent
James J. Cowan, inventor (to NASA) (NASA-NRC) Issued 11 Jun. 1974 4 p Filed 31 May 1973 Sponsored by NASA
(NASA-Case-MFS-22040-1; US-Patent-3,815,969; US-Patent-Appl-SN-365644; US-Patent-Class-350-3.5; US-Patent-Class-96-38.3; US-Patent-Class-96-79) Avail: US Patent Office CSCL 14E

A holographic recording medium with a substrate which has a diffraction grating composed of a number of spaced line ridges on the surface is discussed. The first layer consists of a metal with a plasma wavelength shorter than that of the selected light source. A second layer, or coating, on top of the first layer consists of a thin film of photosensitive emulsion. A diagram of the device is provided. The principles of operation are explained. Official Gazette of the U.S. Patent Office

N74-26947* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHROMATO-FLUOROGRAPHIC DRUG DETECTOR Patent
John A. Parker, John Dimeff, and Alvin H. Heimbuch, inventors (to NASA) Issued 4 Jun. 1974 5 p Filed 25 Apr. 1973
(NASA-Case-ARC-10633-1; US-Patent-3,814,939; US-Patent-Appl-SN-354611; US-Patent-Class-250-373; US-Patent-Class-250-343; US-Patent-Class-250-304) Avail: US Patent Office CSCL 14B

A drug detecting apparatus which includes a chromatographic system for separating particular substances from a sample solution passed through it is described. A source of radiation causes the substance to emit fluorescent radiation as it moves through the chromatographic system. An optical system spectrally separates the fluorescent radiation according to wavelength and for focusing particular portions of the separated spectrum through an exit aperture. A photodetector which is responsive to the radiation passing through the exit aperture develops an electrical signal commensurate with the intensity of the radiation. The electrical signal is recorded to provide an indication of certain characteristics of the substance. Official Gazette of the U.S. Patent Office

N74-26948* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROPHORETIC SAMPLE INSERTION Patent
Louis R. McCreight, inventor (to NASA) (GE, Philadelphia) Issued 4 Jun. 1974 4 p Filed 6 Jun. 1972 Sponsored by NASA
(NASA-Case-MFS-21395-1; US-Patent-3,814,678; US-Patent-Appl-SN-260093; US-Patent-Class-204-180R) Avail: US Patent Office CSCL 14B

Two conductive screens located in the flow path of an electrophoresis sample separation apparatus are charged electrically. The sample is introduced between the screens, and the charge is sufficient to disperse and hold the samples across the screens. When the charge is terminated, the samples are uniformly distributed in the flow path. Additionally, a first separation by charged properties has been accomplished.
Official Gazette of the U.S. Patent Office

N74-26949* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COAXIAL ANODE WIRE FOR GAS RADIATION COUNTERS Patent
William L. Kraushaar, inventor (to NASA) (Wisconsin Univ., Madison) Issued 21 May 1974 6 p Filed 21 Jun. 1973 Sponsored by NASA
(NASA-Case-GSC-11492-1; US-Patent-3,812,358; US-Patent-Appl-SN-372148; US-Patent-Class-250-385; US-Patent-Class-250-374; US-Patent-Class-313-93) Avail: US Patent Office CSCL 14B

The design and characteristics of a gas radiation counter are discussed. The coaxial anode consists of an elongated central wire covered with an electrically insulating sleeve. Several longitudinally discontinuous segments of an electrically conductive coating are disposed about the insulating sleeve in a coaxial pattern along the length of the central wire. The conductive coating segments form a veto or rejection anode at each end of the central wire and a main or primary charge detecting anode between the ends. The segments are coupled together so that the primary charge detecting anode is connected to detection circuitry in anti-coincidence with the veto anodes. Background radiation detected by either of the veto anodes and the primary charge detecting anode is rejected and the sensitivity of the radiation counter device is increased.
Official Gazette of the U.S. Patent Office

N74-26950# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE THERMO-ELECTRIC EFFECT IN WATER
E. S. Bibikov and V. F. Turik May 1973 3 p Transl. into ENGLISH from Priroda (USSR), no. 12, 1966 p 59-60
(NTC-74-11920; Rept-73-132) Avail: NTIS HC $4.00, National Translations Center, John Crerar Library, Chicago, Ill. 60616

An experiment to determine the Seebeck coefficient for hot water and water vapor was conducted. The equipment used in the experiment and the procedure for making the measurements are explained. It was found that the Seebeck coefficient for the cell with water vapor was 1,840 microvolts per degree. For the cell with hot water, the coefficient was 30,000 microvolts per degree. It was established that with regard to the thermo-electric properties of water vapor and boiling water, the Seebeck coefficient exceeds that of the best known semiconductor materials. An explanation for this condition is provided. Author

N74-26951*# Lockheed Electronics Co., Houston, Tex.
PROGRAM CALIB
M. A. Mendlowitz Mar. 1973 11 p
(Contract NAS9-12200)
(NASA-CR-134305; LEC-TM642-216; TM-63-0257-3213-07) Avail: NTIS HC $4.00 CSCL 14B

The program CALIB, which was written to compute noise levels and average signal levels of aperture radiance for the helicopter version of the S-191 filter wheel spectrometer is described. The program functions, and input description are included along with a compiled program listing. F.O.S.

N74-26952# National Oceanic and Atmospheric Administration, Boulder, Colo.
A FEASIBILITY STUDY FOR THE REMOTE MEASUREMENT OF UNDERWATER CURRENTS USING ACOUSTIC DOPPLER TECHNIQUES
C. B. Emmanuel and P. A. Mandics Aug. 1973 39 p refs
(NOAA-TR-ERL-278-WPL-25) Avail: SOD HC $0.65

The remote measurement of underwater currents in the estuarine, coastal, and open ocean environments was studied using a technique of Doppler shift measurement of acoustic waves scattered by irregularities embedded in the water. The scattering cross section for some typical scatteres was estimated based on available information on their concentration and size distribution. The scattering characteristics of suspended particulate and organic matter, gas bubbles, and temperature and current velocity fluctuations were examined. The effects of transmission losses and ambient noise on the signal-to-noise ratio of the returned signal were evaluated, and the results were used to ascertain the feasibility of acoustic Doppler techniques to measure water currents for ranges of up to 1000 m with a varying pulse length resolution of 0.3 to 3 m. This resolution and additional noise consideration necessitate the use of frequencies of the order of several hundred kHz. It is shown that a pulse Doppler current measuring system is feasible. Author

N74-26953# Royal Aircraft Establishment, Farnborough (England).
A COMPREHENSIVE APPARATUS FOR THE NON-DESTRUCTIVE, ELECTROMAGNETIC TESTING OF MATERIALS; FACTORS AFFECTING THE TEST METHOD AND THE POSSIBILITIES OF INTERFERENCE SUPPRESSION
H. Fuchs Nov. 1973 19 p refs Transl. into ENGLISH from Z. Werkstofftech. (Weinheim), v. 1, no. 1, 1970 p 43-48
(RAE-Lib-Trans-1722; BR38411) Avail: NTIS HC $4.00

A system of eddy-current apparatus for the non-destructive testing of materials is presented. It can be adapted to different requirements according to the building-block principle. The mode of operation is discussed and the possibilities of defect-discrimination and suppression of interference signals are demonstrated. Author

N74-26954# Reading Univ. (England). Dept. of Geography.
COMPARISON OF ORIGINAL AND DUPLICATE PHOTOGRAPHY FROM SKYLARK 1181 IN ARGENTINA
J. R. G. Townshend and R. B. Ridgway Nov. 1973 12 p refs
(Contract AT/2035/015)
(UR-RSP-7; S/AI/19E) Avail: NTIS HC $4.00

The results are presented of a comparison between the original and one of the copies for the false-color infrared film from a 150 mm Hasselblad camera onboard a Skylark over Argentina. The method is described and the effect of varying location within a transparency on the correctness of color reproduction on the copy transparencies on field colors is discussed. It is concluded that there is little significant degradation in using copy transparencies. Author (ESRO)

N74-26955# Reading Univ. (England). Dept. of Geography.
KEY TO LOCATION OF ROCKET IMAGERY, AIRCRAFT TRAVERSES, GROUND TRUTH AND AVAILABLE MAPS FOR THE ARGENTINIAN SKYLARKS
C. O. Justice and J. R. G. Townshend Sep. 1973 16 p
(Contract AT/2035/015)
(UR-RSR-1; S/AI/7E) Avail: NTIS HC $4.00

A key to the existing reference data available at Reading concerning the Skylark Argentina project is provided. Ground truth data, aircraft traverses, and areas covered by the Hasselblad 150 mm camera imagery for the major camera positions are given. A list of the photography held is appended together with a list of the number of copies of maps of the study area. Author (ESRO)

N74-26956# Reading Univ. (England). Dept. of Geography.
KEY TO CODING OF IMAGERY AND GROUND TRUTH OF THE ARGENTINIAN SKYLARKS (1181 AND 1182)
J. R. G. Townshend and C. O. Justice Sep. 1973 8 p
(Contract AT/2035/015)
(UR-RSR-2; S/AI/8E) Avail: NTIS HC $4.00

The coding systems for photographs, ground truth, and maps which are used in the interpretation of Skylark imagery from Argentina are described. Author (ESRO)

N74-26957# Interuniversitair Reactor Instituut, Delft (Netherlands).
ON DESIGNING AND TESTING A SETUP WITH MAGNETIZED MIRRORS FOR NEUTRON DEPOLARIZATION MEASUREMENTS IN THE LONG WAVELENGTH RANGE
W. H. Kraan Mar. 1974 72 p refs
(IRI-132-74-01) Avail: NTIS HC $6.75

A facility for neutron polarization measurements in the long wavelength range, with a reasonable degree of polarization and reasonable intensity and making use of magnetized mirrors, is described. In combination with a monochromatizing device of good transmission, a beam of low intensity but reasonable polarization of up to 7 A can be obtained. By using an appropriate neutron filter or a mechanical chopper instead of a thermical crystal, a higher intensity can be expected. By using mirrors polished on both sides a gain intensity of a factor 2 can be obtained. ESRO

N74-26958# Posterijen, Telegrafie en Telefonie, The Hague (Netherlands). Dr. Neher Lab.
ATOMIC STANDARDS [ATOOMSTANDAARDEN]
C. J. Sanders May 1973 36 p In DUTCH
(AD-297) Avail: NTIS HC $5.00

Atomic standards based on cesium-133 and rubidium-87 are discussed and atomic energy level transitions are dealt with. The cesium radiation standard, consisting of crystal oscillator, multiplier, synthesis generator, harmonic generator, and cesium radiation generator, and also the rubidium gas all standard, consisting of crystal oscillator, synthesis generator, multiplier, optical unit, detector, frequency control unit, and rubidium-87 source, are detailed. Author (ESRO)

N74-26959# Unilever Research, Vlaardingen (Netherlands).
A NEW SMALL-VOLUME CELL FOR STUDYING INFRARED SPECTRA OF CHEMISORBED SPECIES
J. Erkelens and W. J. Woesten [1973] 6 p ref Submitted for publication
Avail: NTIS HC $4.00

A cell with a small dead volume was constructed to study the spectra of adsorbed molecules as a function of surface concentration and temperature. A method is given for preparing large adsorbent disks. Author (ESRO)

N74-26960# Army Land Warfare Lab., Aberdeen Proving Ground, Md.
ACQUISITION OF SMALL NO. 2 SOURCES WITH A UV

CORRELATION SPECTROMETER Final Report
Hugh T. Reilly and Gilbert Newcomb (Environ. Meas., Inc., Annapolis) Feb. 1974 42 p
(AD-776378; LWL-CR-05C70A) Avail: NTIS CSCL 17/5

The feasibility of remotely sensing NO2 emissions from a single source was explored using a UV Correlation Spectrometer manufactured by Barringer Research Ltd., Toronto, Canada. Detections were made of a 2.5 ton truck exhaust at 200 meters range and a 30 KW diesel generator at 1050 meters range to demonstrate feasibility of detecting small sources of NO2.
Author (GRA)

N74-26961# Braddock, Dunn and McDonald, Inc., Vienna, Va.
OPERATIONAL TEST INSTRUMENTATION GUIDE. VOLUME 1: SUMMARY
Jan. 1974 85 p refs Prepared in cooperation with RMC Research Corp., Bethesda, Maryland
(Contract DAAG39-73-C-0130)
(AD-776286) Avail: NTIS CSCL 14/2

The United States Army Operational Test and Evaluation Agency (USAOTEA) Instrumentation Guide presents, in three volumes, the results of an operational test-oriented survey of some thirty-three Department of Defense test/training facilities. In addition to the available instrumentation, detailed information is provided on the landscape, airspace, data reduction, and other general support capabilities of each installation. The general support area includes such information as: (a) type, location, size, and commitments of nearby military units; (b) facility access; (c) maintenance and logistics capability; (d) climate and topography; and (e) power/communications availability. Test support equipment mobility is addressed throughout the guide to indicate its flexibility for use. The Summary (Volume 1) presents an overview and provides an easy rapid determination of the general facility capabilities for operational tests of Army materiel as compared, in matrix form, with the other potential test facilities. (Modified author abstract) GRA

N74-26962# Braddock, Dunn and McDonald, Inc., Vienna, Va.
OPERATIONAL TEST INSTRUMENTATION GUIDE. VOLUME 2: US ARMY TEST FACILITIES
Jan. 1974 751 p refs Prepared in cooperation with RMC Research Corp., Bethesda, Maryland
(Contract DAAG39-73-C-0130)
(AD-776287) Avail: NTIS CSCL 14/2

Volume II contains annexes addressing the capabilities of U.S. Army facilities. In addition to the available instrumentation, detailed information is provided on the landspace, airspace, data reduction, and other general support capabilities of each installation. The general support area includes such information as: (a) type, location, size, and commitments of nearby military units; (b) facility access; (c) maintenance and logistics capability; (d) climate and topography; and (e) power/communications availability. Test support equipment mobility is addressed throughout the guide to indicate its flexibility for use. (Modified author abstract) GRA

N74-26963# Braddock, Dunn and McDonald, Inc., Vienna, Va.
OPERATIONAL TEST INSTRUMENTATION GUIDE, VOLUME 3
Jan. 1974 790 p refs Prepared in cooperation with RMC Research Corp., Bethesda, Maryland
(Contract DAAG39-73-C-0130)
(AD-776288) Avail: NTIS CSCL 14/2

Volume III presents information for the non-Army DOD facilities. In addition to the available instrumentation, detailed information is provided on the landspace, airspace, data reduction, and other general support capabilities of each installation. The general support area includes such information as: (a) type, location, size, and commitments of nearby military units; (b) facility access; (c) maintenance and logistics capability; (d) climate and topography; and (e) power/communications availability. Test support equipment mobility is addressed throughout the guide to indicate its flexibility for use. GRA

N74-26964# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF A PSYCHOPHYSICAL PHOTO QUALITY MEASURE
F. R. Clarke, R. I. Welch, and T. E. Jeffrey Jan. 1974 81 p refs
(Contract DAHC49-092-ARO-169; DA Proj. 2Q6-62704-A-721)
(AD-776369; ARI-RR-1178) Avail: NTIS CSCL 14/5

In extracting information from aerial reconnaissance/sensor products, the image interpreter must often work with imagery of less than ideal quality. The Surveillance Systems research program of the Army Research Institute is designed to identify factors of photo quality that can help measure the interpretability of operational imagery. In the present experiment, image scale, atmospheric haze, and image motion were judged to be key factors in operational interpretability of imagery. Laboratory manipulation of representative operational images produced experimental images with controlled degradation of these three factors, separately and in combination. Image interpreters were asked to detect and identify military targets on this degraded imagery. Their scores were used to assess interpretability as a function of scale, haze, and image motion. In a parallel experiment, geometric shapes were positioned on background panels of black, white, and grey. Photographs of this array were degraded with respect to scale, haze, and image motion to the same levels as the first experimental imagery, and similar tests were conducted. (Modified author abstract) GRA

N74-26965# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC UNIT SEEKS OUT DEFECTS
N. Sorokin 8 Mar. 1974 6 p Transl. into ENGLISH from Vechernyaya Moskva (USSR) no. 245, 18 Oct. 1973 p 3
(AD-776934; FTD-HT-23-1535-74) Avail: NTIS CSCL 14/2

The article discusses an instrument which instantaneously seeks out the finest flaws on the surface of articles. Its operating principle is based on excitation of eddy currents in the monitored section. The article also discusses a television X-ray introscope which converts X-radiation into light radiation and transmits it to a television screen. A part which is placed in the instrument is illuminated and the picture of internal defects in the metal appears on the screen; all of its internal diseases are visible - shrinkage defects, cracks, etc. GRA

N74-26966# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
A TECHNIQUE FOR EVALUATING FUEL MIST FLAMMABILITY Interim Report
Bernard R. Wright, Leo L. Stavinoha, and William D. Weatherford, Jr. Dec. 1973 26 p refs
(Contract DAAK02-73-C-0221)
(AD-776965; AFLRL-25) Avail: NTIS CSCL 14/2

Experimental apparatus and procedures for evaluating the mist flammability of neat and fire-safety fuels have been developed. The apparatus, which was developed as part of this laboratory's fuel safety program, is capable of evaluating fuel mist flammability under conditions ranging from low air shear to extremely high air shear. Fuel is delivered through a capillary at a controlled rate, and three impinging air streams form a mist at the point of impingement. The fuel mist passes through an overwhelming ignition source to avoid marginal ignition. Flashback from the ignition source toward the fuel capillary is interpreted as a measure of mist flammability. The technique provides a rapid and reliable laboratory research tool. (Modified author abstract) GRA

N74-26967# Army Engineer Topographic Labs., Fort Belvoir, Va.
FURTHER INVESTIGATION OF AN ELECTRONIC ANGLE-MEASURING DEVICE
William W. Seemuller Dec. 1973 53 p refs
(DA Proj. 4A0-61101-A-91D)
(AD-776948; ETL-TR-74-1) Avail: NTIS CSCL 14/2

The report presents the results of extended experimentation on an electronic angle-measuring device to determine precision and accuracy. The instrument measures an angle by measuring the time it takes a rotating disk to sweep out the angle. Time is indicated by counting the cycles of a stable oscillator which is gated on and off by the disk at points determined by the angle being measured. (Modified author abstract) GRA

N74-26968# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A PHOTOELECTRIC PHOTOMETER FOR THE Fe XIV SOLAR

CORONA
Richard R. Fisher 9 Nov. 1973 14 p refs
(AF Proj. 7649)
(AD-775745; AFCRL-IP-205; AFCRL-TR-73-0696) Avail: NTIS CSCL 03/2

A photoelectric photometer for the emission line 5303 (Fe XIV formed in regions where Te - 2.0 x 10 to the 6th power degrees K) of the solar corona is described in this paper. The emission line is isolated from the scattered light of the sky and the instrument by means of a rapid change in the bandpass of a birefringent filter. A piezoelectric variable retarder is used to accomplish the bandpass modification as a 100 kHz rate. The instrument is capable of detecting the corona in scattered light situations that exceed the maximum allowed for filter photography by a factor of 10; thus, the number of hours during which coronal observations can be made with the photoelectric instrument is significantly larger than the photographic method presently used. An example of synoptic observations of the Fe XIV corona is presented. Spatial resolution achieved is limited by the scan stop in the image plane and is 1.1 arc minutes. Scans are made in position angle, holding the scan distance from the limb a constant. The Fe XIV signal is detected out to a distance of 1.55 R/Ro above the limb. Author (GRA)

N74-26969# Army Missile Command, Redstone Arsenal, Ala. Directorate for Product Assurance.
OPTICAL COMPONENT FUNCTIONAL TESTER Final Report
H. E. Bennett, M. J. Soileau, and G. J. Hutcheson Mar. 1974 25 p
(DA Proj. 3730001)
(AD-777536; QR-TR-74-1) Avail: NTIS CSCL 20/6

Objective new optical surface quality specifications and tests for demonstrating compliance of optical components with the specifications are required both by government and throughout the optical industry. The scratch and dig specifications presently in use are inadequate since (1) they address only the problem of macroirregularities on the surface and thus are not necessarily directly related to system performance, and (2) compliance is determined in a subjective manner. An indirect relationship between scratch and dig specifications and system performance often does exist, which if understood may make it possible to extend and quantify these specifications. In this way the system designer can be provided with an objective means for determining adequate specifications for optical components while still minimizing their cost. The relation between surface quality and light scattering from optical components is discussed and an optical functional tester now under development for measuring surface quality and optical performance is described.
Author (GRA)

N74-26970# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Optical Physics Lab.
CALIBRATION OF A LIQUID HELIUM COOLED CVF RADIOMETER IN A WARM ENVIRONMENT Interim Report
Thomas P. Condron 31 Jul. 1973 62 p refs
(AF Proj. 8692)
(AD-777212; AFCRL-TR-73-0480; AFCRL-IP-199) Avail: NTIS CSCL 14/2

Approximate techniques for calibrating a liquid-helium-cooled radiometer in a warm environment are discussed and applied to a liquid-helium-cooled circular variable filter radiometer launched on a rocket in Alaska in March 1973. Author (GRA)

N74-26971# Naval Intelligence Support Center, Washington, D.C. Translation Div.
AUTOMATION OF FATIGUE TESTS OF FULL SCALE STRUCTURES
V. I. Litvak 15 Jan. 1974 38 p Transl. into ENGLISH from the book "Avtomatizatsiya Ustalostnykh Ispytanii Naturnykh Konstruktsii" Moscow, 1972 p 5-36
(AD-777449; NISC-Trans-3495) Avail: NTIS CSCL 14/2

Contents: Fatigue strength of structures and methods of its determination; General principles for constructing automated equipment for full-scale fatigue tests. GRA

N74-26972# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
SOSTEL (SOLID STATE ELECTRIC LOGIC) DESIGN MATRIX, DHS (DATA HANDLING SYSTEM) CONFIGURATION CONTROL AND TECHNICAL CONSULTATION Final Report, 8 Feb. - 31 Oct. 1973
J. R. Perkins, A. J. Marek, and J. L. Jones 1 Nov. 1973 253 p refs
(Contract N62269-73-C-0402)
(AD-777107; Rept-2-57110/3R-3131) Avail: NTIS CSCL 01/4

The study was conducted to develop guidelines for applying SOSTEL to aircraft electrical systems in general. The A-7 and P-3C electrical systems were used to establish requirements for typical systems and to form model circuits from which the design guidelines were evolved. Data was generated and graphs were plotted which provides the designer a means for determining the level of improvement SOSTEL offers over conventional designs in terms of weight and volume considering such variables as size of system, complexity of system and the ratio of input signals to output signals. Application considerations that should be followed when implementing the SOSTEL system are presented. Emphasis is placed upon establishing compatibility between loads and load controllers. Various utilization equipment was operated with power controllers and operational performance are discussed. Requirements for configuration control for the SOSTEL DHS software and hardware were investigated and a concept is presented which will prevent eroneous application and installation of the software and hardware in the aircraft. (Modified author abstract) GRA

N74-26973*# Aerospace Corp., El Segundo, Calif.
X-RAY EVALUATION OF CRYSTALS FOR STELLAR SPECTROMETERS Technical Report, Oct. 1972 - Apr. 1973
Nikos G. Alexandropolos, ed. 29 Mar. 1974 86 p refs
(Contracts NAS8-27404; F04701-73-C-0074)
(NASA-CR-138781; SAMSO-TR-74-83; AD-777161; TR-0074(9260-02)-1) Avail: NTIS HC $7.50 CSCL 14/2

The report consists of three parts. The first part is an analysis of the principles involved in X-ray crystal evaluation and how they are applied to a number of crystals. The principles of crystal evaluation analysis as they apply to the special problems of X-ray astronomy are presented. A number of crystals were evaluated, and the energy dependence of the diffraction properties of (002) PET, (111) Ge, (101) ADP, (001) KAP, and (001) RAP are reported. The second part is a compilation of the diffraction properties of a number of crystals as reported by other authors. In the third part some technical details of a triple crystal spectrometer built by the author at Polytechnic Institute of Brooklyn are given. This spectrometer seems to be a most appropriate instrument for evaluation of crystal properties. (Modified author abstract) GRA

N74-26974# Harry Diamond Labs., Washington, D.C.
PRELIMINARY EVALUATION OF A PROPOSED LASER-OPERATED FLAW DETECTION TECHNIQUE
Dominick A. Giglio Dec. 1973 27 p refs
(DA Proj. 1W3-62301-A-207)
(AD-777524; HDL-TM-73-32) Avail: NTIS CSCL 14/2

A preliminary investigation of a proposed flaw detection technique was conducted. Conventional flaw-detection schemes employ piezoelectric transducers and use the reflection of acoustic energy inside the sample to locate irregularities. The method generally requires positioning the item in a testing tank or in a flowing-fluid test fixture to facilitate better input and output coupling of the acoustic energy. This requirement, which represents a serious drawback in the testing procedure, is completely avoided in the proposed scheme. The proposal entails the use of a laser to launch an acoustic wave in the test object, and a separate laser interferometer system to detect the reflected wave. The required rough surface interferometer has been successfully operated and may have applications other than proposed here. Tests were also made on the optical generation of acoustic waves, and results indicate that further consideration of the proposed system is merited. Author (GRA)

N74-26975# Texas Instruments, Inc., Dallas. Equipment Group.
INVESTIGATION OF A PARAMETRIC RESONANCE MAGNETOMETER USING OPTICALLY PUMPED HELIUM 4 Final Report, 18 Nov. 1972 - 15 Jan. 1973
Robert E. Slocum and Douglas D. McGregor Mar. 1974 55 p refs
(Contract N00014-72-C-0104)
(AD-777066; TI-U1-844010-1) Avail: NTIS CSCL 08/14

The report describes the investigation of parametric resonances and the use of resulting resonances for measuring magnetic fields. This work includes investigation of the 2 triplet S(1) level of helium 4 by parametric resonances and establishes the feasibility of constructing a vector magnetometer using the parametric resonance n=1. A device of this type was demonstrated to have a peak-to-peak noise level of 1.0 x 10 to the minus 7th power G in a5.0 Hz noise bandwidth when used to monitor a component of the geomagnetic field. Author (GRA)

N74-26831 Oxford Univ. (England). Dept. of Engineering Science.
A THIN-FILM PROBE FOR TWO-DIMENSIONAL VELOCITY MEASUREMENTS
In its Develop. of Thin-Film Probes for Velocity Meas. 1974 17 p refs Sponsored by UK Sci. Res. Council (For availability see N74-26830 16-12)

N74-26832 Oxford Univ. (England). Dept. of Engineering Science.
DEVELOPMENT OF A HOT-FILM GAUGE SUITABLE FOR THE MEASUREMENT OF A THREE-DIMENSIONAL VELOCITY VECTOR
In its Develop. of Thin-Film Probes for Velocity Meas. 1974 24 p refs Sponsored by UK Sci. Res. Council (For availability see N74-26830 16-12)

N74-27321* Arizona Univ., Tucson.
MULTICOLOR PHOTOGRAPHY OF JUPITER
J. W. Fountain and S. M. Larson *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 315-326 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 14E

N74-27322* Arizona Univ., Tucson.
NARROW-BAND PHOTOGRAPHY OF JUPITER AND SATURN
John W. Fountain *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 327-337 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-26976* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPRAG SOLENOID BRAKE Patent
Dan H. Dane, inventor (to NASA) Issued 28 May 1974 5 p Filed 14 May 1973 Supersedes N73-23552 (11 - 14, p 1670)
(NASA-Case-MFS-21846-1; US-Patent-3,812,936; US-Patent-Appl-SN-359958; US-Patent-Class-188-171; US-Patent-Class-188-163) Avail: US Patent Office CSCL 13I

The development and characteristics of an electrically operated brake are discussed. The action of the brake depends on energizing a solenoid which causes internally spaced sprockets to contact the inner surface of the housing. A spring forces the control member to move to the braking position when the electrical function is interrupted. A diagram of the device is provided and detailed operating principles are explained.
Official Gazette of the U.S. Patent Office

N74-26977* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVICE FOR CONFIGURING MULTIPLE LEADS Patent
Paul W. Clemens, inventor (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Issued 11 Jun. 1974 7 p Filed 2 Mar. 1973 Sponsored by NASA
(NASA-Case-MFS-22133-1; US-Patent-3,815,205; US-Patent-Appl-SN-337487; US-Patent-Class-29-203MW) Avail: US Patent Office CSCL 13I

A device for simultaneously configuring multiple leads projected from a printed circuit affixed to a circuit board is described. The device is characterized by a receptacle adapted to receive and support a circuit board having multiple leads, a first locking mechanism for securing the base portion of the leads against motion relative to the circuit board, and a second locking mechanism, spaced from the receptacle and mounted on a carriage for securing the distal end portions of the leads relative to the carriage. The carriage, in turn, is supported for a simultaneous motion in vertical and horizontal planes for imparting selective motion to the carriage, so that leads secured by the locking mechanisms are deformed to a preselected configuration. Official Gazette of the U.S. Patent Office

N74-26978*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECTS OF SOLID PARTICLES IN OIL ON THE LIFE OF BALL BEARINGS
J. Okamoto, K. Fujita, and T. Yoshioka Washington NASA May 1974 30 p refs Transl. into ENGLISH from J. Mech. Eng. Lab. Jap. (Tokyo), v. 26, no. 5, Sep. 1972 p 228-238
(Contract NASw-2481)
(NASA-TT-F-15653) Avail: NTIS HC $4.50 CSCL 13I

The effect of solid particles in oil on fatigue life and wear of ball bearings was studied. Fatigue tests were run on No. 6204 ball bearings, operated under a radial load of 500 kg at a speed of 1150 rpm. Alumina powders Al2O3 or No. 7 testing powder (JIS Z 8901) were suspended in the lubricating oil. Alumina powders (particle diameter 120 or 35 microns, 10 mg/hour or 10 mg every 8 hours) decreased bearing life by 1/10 or 2/10 of standard life in oil without suspended particles. Alumina powder (diameter 20, 10 mg every 8 hours) and No. 7 powder (diameter 2-80 microns, 10 mg/hour) decreased life by 4/10-6/10. Radial clearance measurements showed wear of tested bearings, which was higher in the case of alumina powders than in oil; increase of radial clearance was ~10 to 360 microns. It was from ~10 to 12 microns in No. 7 powder. Bearing life in cases of solid particles was decreased by stress concentration due to projection of rolling bands caused by wear differences between pure rolling bands and slip bands in contact areas and increase of surface roughness of ball and race. Author

N74-26979*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID ROCKET VALVE ASSEMBLIES NASA Space Vehicle Design Criteria (Chemical Propulsion)
Washington Nov. 1973 154 p refs
(NASA-SP-8097) Avail: NTIS HC $5.00 CSCL 13K

The design and operating characteristics of valve assemblies used in liquid propellant rocket engines are discussed. The subjects considered are as follows: (1) valve selection parameters, (2) major design aspects, (3) design integration of valve subassemblies, and (4) assembly of components and functional tests. Information is provided on engine, stage, and spacecraft checkout procedures. Author

N74-26980# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EROSION BY ION BOMBARDMENT
M. Marchal and M. Cantagrel Apr. 1973 37 p refs Transl. into ENGLISH of Thomson-CSF, Central Res. Lab., Bagneux, France, report, Jan. 1973
(NTC-74-50414; Rept-73-116) Avail: NTIS HC $5.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Variations in the sputtering yield of a material subjected to bombardment by an ion beam are discussed. The yield varies according to whether or not the residual gas present at the

level of the bombarded material is capable of inducing the formation of a chemisorbed layer. In the case where the gas used is oxygen which is chemically active with respect to most metals, the sputtering yield is reduced considerably and the metal behaves like its oxide. This phenomenon has been studied with several metals used as masks and several substrates. It is possible to achieve amplification coefficients of three to ten between the height of the mask and that of the etching obtained. Author

N74-26981*# United Aircraft Corp., East Hartford, Conn.
RESEARCH STUDY ON MATERIALS PROCESSING IN SPACE, M566 EXPERIMENT
Frank C. Douglas and Francis S. Galasso 18 Jun. 1974 48 p ref
(Contract NAS8-28724)
(NASA-CR-120235; N911360-24) Avail: NTIS HC $5.25 CSCL 13H

Specimens of the aluminum-33 wt% copper eutectic partially melted and resolidified in the low effective gravity of the orbiting Skylab were examined and characterized with respect to microstructural defects and thermal conductivity values. The results obtained were compared with similar evaluations of ground-based simulation melt-resolidification experiments and as-prepared unidirectionally solidified specimens. Thermal conductivity data and electrical resistivity data at temperatures from 25 C to 400 C did not show significant differences between ground and space processed specimens. A methology of evaluating the defects in the Al-Al2Cu structure was implemented. A specimen from Skylab 3 showed signs of instability in growth and several grains were found in the ingot. The specimen from Skylab 4 did not show such marked instability in growth and was found to contain fewer defects than the ground-processed specimens. This agrees with data from Georgia Institute of Technology which showed that there were fewer defects in both their Skylab 3 and 4 specimens than in ground processed specimens. Author

N74-26982# National Bureau of Standards, Washington, D.C.
REPORT OF THE 58th NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, 1973
Sandra J. Wilson, ed. and Richard N. Smith, ed. May 1974 210 p Conf. held at Minneapolis, 22-27 Jul. 1973
(NBS-SP-391; LC-26-27766) Avail: SOD HC $2.50 as C13.10:391

The test of addresses presented to the conference attended by state, county, and city weights and measures officials, the Federal Government, and business, industry, and consumer organizations are reported. Topics included: (1) universal product code in the grocery industry; (2) digital designs in weighing systems; (3) gasoline measurement and marketing; (4) postal weighing; (5) management assistance for weights and measures progress; and (6) new approaches in weights and measures operations especially in consumer affairs. The reports of standing committees are also included. A.A.D.

N74-26983# Committee on Science and Astronautics (U. S. House).
METRIC CONVERSION ACT OF 1973
Teague Washington GPO 23 Oct. 1973 22 p ref Report to accompany H.R. 11035 presented by the Comm. on Sci. and Astronaut. to the Comm. of the Whole House on the State of the Union, 93d Congr., 1st Sess., 23 Oct. 1973
(H-Rept-93-604; GPO-99-081) Avail: US Capitol, House Document Room

Congressional action was taken to declare a national policy of converting to the metric system in the United States and to establish a National Conversion Board to coordinate the voluntary conversion to the metric system over a period of ten years. The composition and functions of the National Metric Conversion Board are explained. The legislative history of the bill is discussed. The rationale for enacting the bill is analyzed. A cost analysis of the conversion plan over a period of five years is developed. Author

N74-26984*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RELIABILITY AFTER INSPECTION
John R. Davidson 1973 24 p refs Presented at the ASTM Symp. on the Fatigue of Composite Mater., Bal Harbour, Fla., 2-7 Dec. 1973
(NASA-TM-X-71969) Avail: NTIS HC $3.00 CSCL 14D

Flaws are occasionally overlooked during non-destructive inspections, and consequently the products are not 100 percent reliable. The quantitative relationships among the probability of having manufacturing defects, the probability of detecting a flaw, and final reliability are established. Several specific situations are considered: where a flaw might be present; where a random number of flaws are randomly scattered throughout the piece; where some parts of the product are not accessible for inspection; and a general case where various portions are more easily inspected than others, more or less likely to contain flaws than others, or are not inspectable while other portions are. Author

N74-26985*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT TECHNOLOGY: A COMPILATION
[1974] 22 p refs
(NASA-SP-5926(03)) Avail: NTIS HC $81.00 CSCL 14D

Technical information is presented on measurement techniques and instruments, measurement applications for inspection activities, measurement sensors, and data conversion methods. Photographs or diagrams are included for each instrument or method described, and where applicable, patent information is given. A.A.D.

N74-26986*# National Aeronautics and Space Administration, Washington, D.C.
MATERIAL CUTTING, SHAPING, AND FORMING: A COMPILATION
[1974] 28 p refs
(NASA-SP-5922(02)) Avail: NTIS HC $1.00 CSCL 13H

Information is presented concerning cutting, shaping, and forming of materials, and the equipment and techniques required for utilizing these materials. The use of molds, electrical fields, and mechanical devices are related to forming materials. Material cutting methods by devices including borers and slicers are presented along with chemical techniques. Shaping and fabrication techniques are described for tubing, honeycomb panels, and ceramic structures. The characteristics of the materials are described. Patent information is included. F.O.S.

N74-26987*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CHLORINE PURIFICATION ON OXIDATION RESISTANCE OF SOME MECHANICAL CARBONS
Donald W. Wisander and Gordon P. Allen Washington Jun. 1974 12 p refs
(NASA-TN-D-7688; E-7809) Avail: NTIS HC $3.00 CSCL 11D

Oxidation experiments were conducted with some experimental and commercial mechanical carbons at 650 C in dry air flowing at 28 cc/sec (STP). In general, purification of these carbon-graphites with chlorine at 2800 C improved oxidation resistance. Additional improvements in oxidation resistance were obtained from purification followed by an antioxidant (zinc phosphate) treatment. For the commercial materials, purification alone gave greater oxidation resistance than the antioxidant treatment alone. The reverse, however, was the case for the experimental materials. Author

N74-26988*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
QUICK DISCONNECT FILTER COUPLING Patent Application
Fred Jankowski, inventor (to NASA) Issued 30 May 1974 13 p
(NASA-Case-MFS-22323-1; US-Patent-Appl-SN-474745) Avail: NTIS HC $4.00 CSCL 13E

The invention relates to a quick disconnect filter coupling for use in coupling a pair of lines together through which fluid passes. The device is particularly applicable in the space shuttle program wherein prior to re-using the space shuttle couplings utilized in fueling the launching the space shuttle must be cleaned for removing all contaminants therefrom. The quick disconnect filter coupling includes a male portion which is normally mounted on the skin of a missile adapted to receive a female portion. Within the male portion is a removable filter cartridge. The filter

cartridge includes a check valve and a filter medium. Normally, before the coupling is re-used a purge assembly, is utilized for cleaning contaminants from the coupling device. The novelty of the invention appears to lie in providing a quick disconnect filter coupling which has a filter assembly that can be readily removed and a purging device coupled thereto for cleaning contaminants therefrom. NASA

N74-26989*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MIXING INSERT FOR FOAM DISPENSING APPARATUS Patent Application
William G. Simpson, inventor (to NASA) Issued 12 Jun. 1974 11 p
(NASA-Case-MFS-20607-1; US-Patent-Appl-SN-478800) Avail: NTIS HC $4.00 CSCL 13I

The design and operation of a device for mixing foam are described. The device may be used anywhere that ingredients are mixed and dispensed through a nozzle. One particular application is in dispensing polyurethane foam. The construction of the equipment is illustrated. The novelty of the equipment lies in the feature of forcing the ingredients through one side of the housing to the other as they flow through slots of alternate discs with the ingredients being divided and recombined. NASA

N74-26990# Lehigh Univ., Bethlehem, Pa. Dept. of Metallurgy and Materials Science.
LIMIT ANALYSIS OF FLOW THROUGH CONICAL CONVERGING DIES Final Report, Feb. 1972 - Aug. 1973
Betzalel Avitzur, Walter C. Hahn, Jr., and Samy Iscovici Oct. 1973 46 p refs
(Contract F33615-72-C-1153; AF Proj. 7351)
(AD-776794; AFML-TR-73-259) Avail: NTIS CSCL 13/8

Both upper and lower bound mathematical solutions are presented for axisymmetric flow through conical converging dies. For the upper bound solution, triangular velocity fields have been solved and compared to previously published work on spherical velocity fields. It is found that each type provides a lower solution over a part of the range of process variables. A previously published lower bound solution for axisymmetric flow is refined. Author (GRA)

N74-26991# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A DESCRIPTION OF EXPECTED FAILURE RATES OF NEWLY ACQUIRED COMPONENTS PRIOR TO STEADY STATE M.S. Thesis
Richard F. Erickson and Donald H. Hammond Jan. 1974 143 p refs
(AD-775697; SLSR-29-74A) Avail: NTIS CSCL 14/4

A study of the effects on the population failure rate of component failures during the period of transition to steady state is presented. Comparisons between the simulated failure rates and the system failure rate predicted under the present Air Force assumption on an underlying Poisson process are accomplished for various MTBF's and parameters of the Weibull distribution. The decreasing hazard, constant hazard, and increasing hazard functions are studied and presented. The study was performed as a simulation of the transition period using the GASP 2 package developed by Pritsker and Kiviat. Such a simulation package greatly simplifies the required programs necessary to be written. The computer program used in this study is included as part of this paper. GRA

N74-26992# Westinghouse Research Labs., Pittsburgh, Pa.
GEISHA SEMICONDUCTOR RELIABILITY STUDIES. A PORTION OF CHAIR-GEISHA Final Report, 1 Feb. 1970 - 31 Dec. 1971
John R. Szedon and Karl K. Yu 26 Oct. 1973 104 p refs
(Contract N00014-70-C-0230; NR Proj. 252-002; RF23372101)
(AD-777054) Avail: NTIS CSCL 09/1

The final report describes studies relating to silicon junction diodes to be used for amplifying the current in an electron beam via electron-hole pair production in silicon. Radiation damage effects on the junction reverse leakage are treated in terms of insulator charging effects. Electrical comparisons of shallow diffused and ion implanted junctions are given. Contributions to the thermal impedance of a device of the silicon, gold and beryllia component regions are assessed. Technology is described for producing targets with linear arrays of diodes from a monolithic string of elements formed in silicon. Author (GRA)

N74-26993# FMC Corp., San Jose, Calif. Ordnance Engineering Div.
WELDING STUDY OF ELECTROSLAG REMELTED STEEL ARMOR Final Report, 14 May 1973 - 23 Jul. 1974
Ronald E. Musante, William C. Schultz, and Loren L. Lanier Jan. 1974 50 p refs
(Contract DAAG46-73-C-0195)
(AD-776999; AMMRC-CTR-74-10) Avail: NTIS CSCL 19/4

The purpose of the project was to study welding of electroslag remelted (ESR) steel with high strength filler wires. This report gives a detailed description of welding techniques developed, and a metallurgical and ballistic evaluation of the welds obtained. ESR steel armor at hardnesses suitable for armor piercing projectile protection (514 BHN) was successfully welded. The welds have excellent mechanical and ballistic properties. Welding of ESR 4340 steel with the gas metal-arc welding (GMAW) process, using type 14C welding wire and argon-oxygen (98-2) shield gas, appears to offer no unusual welding problems. Normal good shop practices, using the tempering weld pass technique, will result in welds of high quality. Author (GRA)

N74-26994# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
REFRIGERATION OF SUPERCONDUCTING ROTATING MACHINERY Interim Report, 14 Apr. 1972 - 30 Jun. 1973
Vincent D. Arp Jun. 1973 76 p refs
(AD-774892/4; NBSIR-73-331) Avail: NTIS HC $7.00 CSCL 13/1

Recent work in three areas related to helium refrigeration is summarized. (1) Analysis is given of a possible high pressure refrigeration cycle which offers in principle a reduced component size, but which turns out to be impractical because of expansion engine inefficiencies. (2) Exact equations for flow of a real fluid are derived and applied to problems of fluid flow near the critical point, as may occur with some helium cooled superconducting systems. (3) Three new equations of state for helium are given, each using different state variables, to eliminate the need for iterative techniques in helium refrigeration cycle and fluid flow analysis. Author (GRA)

N74-26995# Battelle Columbus Labs., Ohio.
RESEARCH TECHNIQUES FOR ASSESSMENT OF LUBRICANT DEGRADATION, LUBRICANT DEWETTING, AND SLIP-RING WEAR Technical Report, 1 Feb. - 30 Jul. 1973
Russell D. Stockwell, John W. Kissel, and David B. Hamilton Sep. 1973 72 p
(Contract F33615-73-C-5087; AF Proj. 7343)
(AD-777571; AFML-TR-73-242) Avail: NTIS CSCL 13/9

Three experimental apparatuses were designed, constructed, and delivered to the Air Force Materials Laboratory. These apparatuses will be used to develop experimental data which can be used to devise accelerated life tests for bearings and slip rings for mechanically despun antenna drive systems for Air Force communications satellites. Two apparatuses were designed for the purposes of studying lubricant degradation and dewetting in ball bearings operating in vacuum. The third apparatus was designed to evaluate lift tests for slip rings operating in vacuum. The report appendices contain operating instructions for the various apparatuses. Author (GRA)

N74-26996# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STRUCTURAL CHARACTERISTICS OF BEARING BUSHES MADE FROM NONMETALLIC MATERIALS
B. A. Arkhangelskii and A. V. Kulapin 12 Oct. 1973 13 p Transl. into ENGLISH from the publ. "Sudovye Podshipniki iz Nematallicheskikh Materialov" Leningrado, Sudostr, 1969 p 48-58
(AD-777408; NISC-Trans-3460) Avail: NTIS CSCL 13/19

Contents: Effect of the mechanical and physical properties and structure of nonmetallic materials on the design of bearing bushes; Requirements for the materials and designs of propeller

shaft bearings with nonmetallic bushes; Lubrication and cooling of friction surfaces in the bearings of propeller shafts. GRA

N74-26997# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
SURFACE INTERACTIONS AND LUBRICATION RESPONSE OF SILICON NITRIDE BEARING ELEMENTS
H. Dalal, Y. P. Chiu, J. I. McCool, and O. G. Gustafsson Feb. 1974 112 p refs
(Contract N00019-73-C-0150)
(AD-777087; SKF-AL74P009) Avail: NTIS CSCL 13/9

The report summarizes results of a fundamental investigation of the suitability of silicon nitride as a rolling bearing material with emphasis on its interactive behavior with lubricating fluids. The need for a light-weight bearing material in critical high-speed turbine applications is discussed and the potential benefits of silicon nitride in particular are reviewed. The wettability characteristics of six lubricants on a silicon nitride surface were measured to determine which lubricants are apt to be successful with silicon nitride bearing components in permitting the replenishment of lubricant onto the rolled-over tracks which is vital for the maintenance of an elastohydrodynamic (EHD) film and the consequent prevention of surface initiated fatigue. (Modified author abstract) GRA

N74-26998# Battelle Columbus Labs., Ohio.
AIRCRAFT PROPULSION LUBRICATING FILM ADDITIVES: BOUNDARY LUBRICANT SURFACE FILMS, VOLUME 1 Techical Report, 3 Feb. - 30 Nov. 1973
C. M. Allen, E. J. Drauglis, W. A. Glaser, C. A. Alexander, and R. J. Jakobsen Jan. 1974 82 p refs
(Contract F33615-73-C-2026; AF Proj. 3048)
(AD-777590; AFAPL-TR-73-121-Vol-1) Avail: NTIS CSCL 11/8

The hypothesis under study is that boundary films possess properties significantly different from those of bulk fluids because of the presence of molecular interacting forces which tend to produce ordered, molecularly oriented, multilayered, relatively thick (5000 A) surface films. Experimental research on the detection of ordering is being carried out by means of frustrated-multiple-internal-reflection, infrared spectroscopy while the thermal properties, including heats of sorption, are being conducted on a very sensitive mass-spectrometric molecular-effusion instrument. The friction, shear stress, and damping behavior of the surface films are being studied with a stick-slip friction apparatus. The whole is being supported by theoretical analysis with a view to developing a mathematical model for application to the development of practical boundary lubricants for aircraft propulsion systems. The subject report is the first of three, and it is devoted to investigations of straight-chain hydrocarbon solvent/solute systems using the techniques just described. (Modified author abstract) GRA

N74-26809* Mechanical Technology, Inc., Latham, N.Y.
ASPERITY LUBRICATION AND CAVITATION IN FACE SEALS
J. A. Walowit *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 77-87 refs (For availability see N74-26800 16-12) CSCL 11A

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-26999 Stanford Univ., Calif.
GENERATING PICOSECOND OPTICAL PULSES Ph.D. Thesis
Michael Franklin Becker 1974 91 p
Avail: Univ. Microfilms Order No. 74-13600

Experimental and theoretical results are presented for the generation of ultrashort optical pulses via the mode locking of lasers and optical parametric oscillators. In the laser case attention is focused upon the harmonic mode locking of a Nd:YAG laser with an intractivity phase modulator operating at N = , 2, 3, 4, and 5 times the fundamental c/2L frequency. A computerized frequency-domain simulation for this problem using a Fast Fourier Transform approach gives results which are in good agreement with the analytical solutions for the limiting cases. In a practical device, maximum pulse shortening is obtained when pumping a parametric oscillator with a Q-switched burst of mode-locked pulses. Pulses as short as 1/4 the length of the pump pulse can be obtained. In a steady-state device, significant pulse shortening is obtained only very near threshold. Dissert. Abstr.

N74-27000 Pennsylvania Univ., Philadelphia.
ANALYSIS AND OPTIMIZATION OF DISCRETE FRESNEL LASER RESONATORS Ph.D. Thesis
Arthur Joseph VanDereedt 1973 383 p
Avail: Univ. Microfilms Order No. 74-14150

A theoretical study was undertaken of the focusing properties of the continuous Fresnel pattern to determine its utility as an output coupling aperture for laser resonators. The continuous Fresnel mirror resonator was compared to the central hole aperture resonator for mode suppression and aperture efficiency in single mode oscillation. A discrete Fresnel mirror resonator was approximated and optimized to its continuous counterpart so that a discrete type of aperture could be realized for lasers in the infrared to visible frequencies, particularly the CO2 laser. A study of the active saturable resonator was then made for the discrete Fresnel mirror to determine saturation effects and power coupled out. The multiple output focusing effects of this resonator were analyzed. Finally two experimental resonators were scaled to the microwave region so that the computer optimization could be verified. Dissert. Abstr.

N74-27001 Texas A&M Univ., College Station.
SYSTEM OPERATIONAL ANALYSIS OF THE FEASIBILITY OF SPACEBORNE LASER COMMUNICATIONS Ph.D. Thesis
Wayne Laverne Ohern, Jr. 1973 298 p
Avail: Univ. Microfilms Order No. 74-13093

Laser technology will outperform microwave technology for wideband data links between earth-orbiting satellites. Potential applications are common-carrier relay and data recovery for low earth-orbiting satellites. The level of the resulting telecommunications demand is estimated through the year 1990. System performance parameters which will be critical to future users and the optical effects of the dynamic atmosphere are presented. Recent laboratory component measurements are used to estimate system performance, and the requirements for integration of laser terminals on typical spacecraft are analyzed. Practical applications appear feasible within typical satellite weight allowances. Laser and microwave links are compared on the basis of the burden imposed on the host spacecraft, measured in terms of total weight and costs. A development program is recommended for the introduction of laser terminals into the operational inventory. Dissert. Abstr.

N74-27002*# Maryland Univ., College Park. Dept. of Electrical Engineering.
CO2 LASER COLD CATHODE RESEARCH RESULTS Final Report
U. Hochuli Dec. 1973 29 p Original contains color illustrations
(Grant NGR-21-002-345)
(NASA-CR-139022) Avail: NTIS HC $4.50 CSCL 20E

The construction and processing of four test lasers are discussed, and the test results are assessed. Tests show that the best performance was obtained from cathodes made from internally oxidized Ag-Cu alloys or pure Cu. Due to the cold cathode technology developments, sealed-off 1 w CO2 lasers with gas volumes of only 50 cu cm were duplicated, and have performed satisfactorily for more than 6000 hours. Author

N74-27003# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CONTINUOUS LASER ACTION IN CO2-N2-He MIXTURES AT ATMOSPHERIC PRESSURES
A. S. Provorov and V. P. Chebotaev Apr. 1973 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 208, no. 2 , 1973 p 318-320
(NTC-74-11898; Rept-73-117) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The construction of a tunable continuous carbon dioxide laser

for obtaining laser outputs in gases at high pressures is described. The characteristics of the laser used and the procedures for conducting the experiments are reported. A graph of the laser outputs power as a function of the mixture pressure is provided. The forms of the amplification lines at atmospheric pressure for various laser gases are developed. Author

N74-27004*# Rice Univ., Houston, Tex. Dept. of Physics.
DEVELOPMENT OF ULTRAVIOLET LASERS Final Report
G. K. Walters 15 Apr. 1974 3 p refs
(Grant NGR-44-006-169)
(NASA-CR-138632) Avail: NTIS HC $4.00 CSCL 20E

The pulsed electron accelerator selected for use in the development of ultraviolet laser capability suitable for use in photoexcitation and photoionization studies of the upper atmosphere is reported. Performance figures, installation specifications, and total cost of the equipment are briefly shown, and plans for further studies are outlined. A.A.D.

N74-27005*# Texas Univ., Austin. Dept. of Astronomy.
LUNAR LASER RANGING DATA DEPOSITED IN THE NATIONAL SPACE SCIENCE DATA CENTER: FILTERED OBSERVATIONS FOR JANUARY - JUNE 1972 AND UNFILTERED PHOTON DETECTIONS FOR JULY - DECEMBER 1972
J. Derral Mulholland and Peter J. Shelus Jan. 1974 7 p refs Prepared in cooperation with McDonald Observatory
(Grant NGR-44-012-219)
(NASA-CR-138660; Memo-74-001) Avail: NTIS HC $4.00 CSCL 20E

The documentation to be used in conjunction with the filtered data deposited in the National Space Science Data Center is presented. The data was obtained during laser ranging operations between the McDonald Observatory and Apollo 11, 14, and 15 reflectors for the six months ending June 30, 1972. Unfiltered photon detections for the succeeding six months are also included in the system. Nominal coordinates for the laser ranging equipment are given and the calibration code for filtered data is shown. Data format using the CDC 6600 computer is described. A.A.D.

N74-27006*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATMOSPHERIC TEMPERATURE MEASUREMENTS, USING RAMAN LIDAR
Jack A. Salzman and Thom A. Coney Washington Jun. 1974 25 p refs
(NASA-TN-D-7679; E-7874) Avail: NTIS HC $3.00 CSCL 20E

The Raman-shifted return of a lidar system had been used to make atmospheric temperature measurements. The measurements were made along a horizontal path at temperatures ranging from -30 to 30 C and at ranges of about 100 meters. The temperature data were acquired by recording the intensity ratio of two portions of the rotational Raman spectrum, which were simultaneously sampled from a preset range. These tests verified that the theoretical predictions formulated in the design of the system were adequate. Measurements were made to an accuracy of + or - 4 C with 1-minute temporal resolution. Author

N74-27007# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugbahnvermessung und Navigation.
DEVELOPMENT AND TESTING OF A PULSE LASER STATION FOR RANGE MEASUREMENTS TO ARTIFICIAL EARTH SATELLITES [ENTWICKLUNG UND ERPROBUNG EINER PULS-LASER-ANLAGE ZUR ENTFERNUNGSMESSUNG AN KUENSTLICHEN ERDSATELLITEN]
Kurt Fricke and Karl Schiele Oct. 1973 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-74-03) Avail: NTIS HC $4.75; DFVLR, Porz, West Ger. 9,50 DM

The design, construction, and testing of pulse laser equipment which can be used for range measurements to artificial earth satellites is discussed. The equipment consists of a giant pulse laser transmitter and electro-optical receiver of high sensitivity. An operator tracks the satellite visually by a high power telescope or a TV-camera. Transmitter and receiver are steered by an electro-hydraulic system. The transmitted laser pulses are reflected by retroreflectors fixed to the satellite and recorded by the receiving equipment on the ground. The range to the satellite can be determined from the time interval between the transmitted and the received pulses measured with the aid of a nanosecond counter. The Universal Time of the received pulses is determined by a rubidium clock. The laser station was calibrated with targets on the ground. First range measurements of satellites were successful. Author (ESRO)

N74-27008# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LASER SPECTROSCOPY Final Report
Richard G. Brewer and Aram Mooradian 28 Feb. 1974 659 p refs Presented at an Intern. Conf., Vail, Colorado, 25-29 Jun. 1973 Prepared in cooperation with IBM, San Jose, California
(Grant AF-AFOSR-2500-73; AF Proj. 9751)
(AD-777751; AFOSR-74-0478TR) Avail: NTIS CSCL 20/6

The document presents proceedings of a conference on tunable lasers and high resolution spectroscopy. GRA

N74-27009# Stanford Univ., Calif. Microwave Lab.
DEVELOPMENT OF TUNABLE INFRARED PARAMETRIC OSCILLATORS AND COHERENT TUNABLE SOURCE SPECTROSCOPY Final Report
Robert L. Byer, R. L. Herbst, M. Henesian, and H. Komine Mar. 1974 74 p refs
(Contract N00014-67-A-0112-0070)
(AD-777131; SU-ML-2285) Avail: NTIS CSCL 20/6

Considerable progress in two areas are discussed: generation of tunable coherent sources for spectroscopic applications, and the study of molecular Na2 and Hg2 using optical pumping spectroscopic techniques. The tunable source progress now allows the concept of a widely tunable coherent spectrometer to be seriously considered. As presently designed, the computer controlled spectrometer will tune the entire .22 to 30 micrometers spectral range using nonlinear optical methods. Spectroscopic studies have centered on the diatomic molecules Hg2 and Na2. The interest in the molecules stems from their potential use as coherent sources. In addition, by the use of coherent source optical pumping, quantitative spectroscopic factors can be accurately measured. GRA

N74-27010# Southern Methodist Univ., Dallas, Tex. Dept. of Electrical Engineering.
A STUDY OF SEMICONDUCTOR LASER MODAL FIELDS AND THEIR RADIATION PATTERNS Final Report, 4 May 1971 - 31 Jan. 1974
Jerome K. Butler, R. C. Voges, S. M. Sanzgiri, J. Zoroofchi, and C. S. Wang 28 Feb. 1974 110 p refs
(Contract DAAK02-71-C-0263)
(AD-777521) Avail: NTIS CSCL 20/5

The objectives of this program were: To analyze the index of refraction of various regions of lasers as a function of the aluminum concentration in (AlGa)As so that lasers can be synthesized with optimum radiation patterns in the sense that the power beamwidth will be minimized; to produce design curves showing the beamwidth for various laser structures; and, to investigate laser structures which produce waveguide modes giving the smallest possible radiation pattern divergence. GRA

N74-27011# RAND Corp., Santa Monica, Calif.
A QUANTITATIVE THEORY OF AN ELECTRON-BEAM-EXCITED CARBON MONOXIDE GAS DYNAMIC LASER. 1: FORMULATION
C. C. Chen Oct. 1973 70 p refs
(Contract F44620-73-C-0011)
(AD-777143; R-1321-PR) Avail: NTIS CSCL 20/5

A new concept for a high power CO gas dynamic laser, coupling a supersonic expansion nozzle and an electron beam preionizer-sustainer discharge system, that promises both the high efficiency of an electrically pumped CO GDL and the high power of a thermally pumped CO GDL. The superiority of the proposed laser to existing CO lasers for atmospheric application is shown. General operational characteristics of a CO laser, and a state of the art review of the various types of continuous-wave CO lasers are given. The principle of anharmonic (V-V) pumping is presented, and the excitation and inversion mechanisms of these CO lasers are described. Finally, a quantitative theory is formulated to

describe the new laser, and a frozen flow approximation of the problem is proposed. (Modified author abstract) GRA

N74-27012# Hughes Research Labs., Malibu, Calif.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS Final Report, 15 Jun. 1972 - 15 Dec. 1973
Concetto R. Giuliand and Robert W. Hellwarth Feb. 1974 103 p refs
(Contract F19628-72-C-0348; AF Proj. 2042)
(AD-777146; AFCRL-TR-74-0104) Avail: NTIS CSCL 20/6

The report contains the results of damage experiments performed at 0.694 and 1.06 micrometer using well-controlled Q-switched ruby and Nd:YAG lasers. Materials studied at 1.06 micrometer are proustite (Ag3AsS3) and lithium niobate (LiNbO3). Surface damage thresholds were measured for proustite for different conditions of pulse repetition rate and pulse duration. A discussion of the theories of optical avalanche breakdown is presented in which doubts are raised as to whether intrinsic breakdown has ever been observed. Arguments are presented that support the likelihood that ionic impurities play a crucial role in optical breakdown. (Modified author abstract) GRA

N74-27013# Aerospace Corp., El Segundo, Calif.
REACTING FLOW AND PRESSURE RECOVERY PROCESSES IN HF/DF CHEMICAL LASERS Technical Report, Sep. 1969 - Sep. 1973
Walter R. Warren, Jr. 30 Nov. 1973 46 p refs
(Contract F04701-73-C-0074)
(AD-777162; TR-0074(9240-02)-1; SAMSO-TR-74-68) Avail: NTIS CSCL 20/5

Several properties of gas dynamic processes that occur in flowing gas lasers are discussed and their importance in establishing laser performance is outlined. The continuous HF (or DF) supersonic diffusion chemical laser is chosen to illustrate the coupling between chemical energy release and fluid dynamics in a laser of current interest. A simplified quasi-one-dimensional analysis is used to illustrate the energy release rates in different parts of a combustion-heated DF laser. The complex nature of the reacting mixing flow in the lasing zone is described, and the properties of the initial reaction generated shock waves in the flow are estimated through a displacement thickness analysis. Finally, a partial constant area concept for use with a supersonic diffusion chemical laser is analyzed. (Modified author abstract) GRA

N74-27014# Naval Intelligence Support Center, Washington, D.C. Translation Div.
THE LASER IN THE SERVICE OF THE PENTAGON
A. N. Bandura 14 Nov. 1973 8 p Transl. into ENGLISH from SSha Ekonomika, Politka, Idealogiya (USSR), no. 3, 1973 p 95-97
(AD-777431; NISC-Trans-3471) Avail: NTIS CSCL 15/3

Lasers and their use in military operations including combat situations are examined. Specifically, laser guidance systems, laser destructive weapons (guns), laser heat weapons, laser photointerpretation equipment, laser missile tracking systems, laser apparatus for missile defense radar, and laser altimeters are discussed. E.H.W.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-27015 Pennsylvania Univ., Philadelphia.
PRECIPITATION IN THIN FOILS OF Al-4 wt. PERCENT Cu ALLOYS Ph.D. Thesis
Sung Kwon Kang 1973 284 p
Avail: Univ. Microfilms Order No. 74-14084

Precipitation in thin foils of Al-4 wt. % Cu alloys was directly investigated by means of high temperature transmission electron microscopy. Equilibrium precipitate crystals of the theta phase were the main object of the work. The morphology, crystallography, interfacial structure, and growth kinetics of formed theta directly in thin foils have been studied in order to understand the mechanism of precipitation in thin foils. The results obtained here can be employed to elucidate the morphology of bulk theta precipitates, and they also demonstrated that high temperature transmission electron microscopy can be successfully employed for studying problems of morphology in complex crystallographic systems. This study has direct bearing on the performance of thin film devices which depend on Al-4 wt. % Cu alloy as support materials. Dissert. Abstr.

N74-27016 Pennsylvania Univ., Philadelphia.
MASS SPECTROMETRIC STUDIES OF SOME COMPLEX METALLURICAL SOLUTIONS Ph.D. Thesis
Uppala Veeraiah Choudary 1973 317 p
Avail: Univ. Microfilms Order No. 74-14037

By mass spectrometrically sampling the Knudsen cell effusates, the ion-current ratio technique has been successfully applied to study two important classes of complex solutions of metallurgical interest, i.e., ferrour solutions and silicate solutions. The usefulness of some of the relevant models and formalisms for these solutions was assessed by comparing the experimental results with the calculated values. By making use of the relations between the activity coefficients and the integrating functions, two useful methods of studying interaction between the solutes in a solvent are presented. A new method of investigation of silicate solutions along with the necessary thermodynamic treatment was presented. The deviations from ideal silicate mixing at meta, di and tetrasilicate sections were found to be small and consistent with present knowledge of deviations in silicates containing divalent metal oxides. Dissert. Abstr.

N74-27017*# Linguistic Systems, Inc., Cambridge, Mass.
ALLOY SOFTENING IN BODY-CENTERED CUBIC METALS
Edwin Pink Washington NASA Jun. 1974 41 p refs Transl. into ENGLISH, Legierrungsentfestigung, Austria, v. 64, no. 12, 1973 p 871-881
(Contract NASw-2482)
(NASA-TT-F-15635) Avail: NTIS HC $5.25 CSCL 11F

Range of thermally activated deformation of bcc metals are investigated. Alloying with substitutional and interstitial elements can cause a reduction of the critical resolved shear stress. In iron alloys this occurs between 100 and 300 K. The theories are manifold. Apparently alloy softening cannot be explained by one single mechanism. Depending on the type of alloy, the easy nucleation of double kinks, scavenging, and the resulting change in deformation mechanism may be responsible. Author

N74-27018# Environmental Protection Agency, Research Triangle Park, N.C.
BERYLLIUM AND ITS DETERMINATION
G. Kurchatova [1973] 12 p refs Transl. into ENGLISH from Khig. Zdravenopazvane (Sofia), no. 14, 1971 p 303-307
(APTIC-41192) Avail: NTIS HC $4.00

Data are presented on the distribution of Be, its sources for elimination in the air, and the toxicity of Be and its compounds. A review was made of the methods of determining Be distribution. Author

N74-27019*# Michigan Univ., Ann Arbor.
FEATURES CONTROLLING THE EARLY STAGES OF CREEP DEFORMATION OF WASPALOY
Alberto Ferrari and David J. Wilson [1974] 27 p refs
(Grant NGL-23-005-005)
(NASA-CR-138780) Avail: NTIS HC $4.50 CSCL 11F

A model has been presented for describing primary and second stage creep. General equations were derived for the amount and time of primary creep. It was shown how the model can be used to extrapolate creep data. Applicability of the model was demonstrated for Waspaloy with gamma prime particle sizes from 75 - 1000 A creep tested in the temperature range 1000 - 1400 F (538 - 760 C). Equations were developed showing the dependence of creep parameters on dislocation mechanism, gamma prime volume fraction and size. Author

N74-27020*# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
RELATIONSHIP OF MECHANICAL CHARACTERISTICS AND MICROSTRUCTURAL FEATURES TO THE TIME-DEPENDENT EDGE NOTCH SENSITIVITY OF INCONEL 718 SHEET
David J. Wilson [1971] 40 p refs
(Grant NGL-23-005-005)
(NASA-CR-138772) Avail: NTIS HC $5.00 CSCL 11F

Time-dependent notch sensitivity of Inconel 718 sheet was observed at 900 F to 1200 F (482 - 649 C). It occurred when edge-notched specimens were loaded below the yield strength and smooth specimen tests showed that small amounts of creep consumed large rupture life fractions. The severity of the notch sensitivity was reduced by decreasing the solution temperature, increasing the time and/or temperature of aging and increasing the test temperature to 1400 F (760 C). Elimination of time-dependent notch sensitivity correlated with a change in dislocation motion mechanism from shearing to by-passing precipitate particles. Author

N74-27021*# Battelle-Northwest, Richland, Wash.
PROPERTY INVESTIGATION AND SPUTTER DEPOSITION OF DISPERSION-HARDENED COPPER FOR FATIGUE SPECIMEN FABRICATION Final Report
E. D. McClanahan, R. Busch, and R. W. Moss 12 Nov. 1973 43 p refs
(Contract NAS3-17491)
(NASA-CR-134542) Avail: NTIS HC $5.25 CSCL 11F

Sputter-deposited alloys of dispersion-hardenable Cu-0.25 vol% SiC and Cu-0.50 vol% SiC and precipitation-hardenable Cu-0.15 wt% Zr and Cu-0.05 wt% Mg-0.15 wt% Zr-0.40 wt% Cr were investigated for selection to evaluate fatigue specimen performance with potential application in fabricating regeneratively cooled rocket thrust chambers. Yield strengths in the 700 to 1000-MN/sq m range were observed with uniform elongation ranging from 0.5 to 1.5% and necking indicative of greater ductility. Electrical conductivity measured as an analog to thermal conductivity gave values > 90% IACS for Cu-0.15 wt% Zr and Cu-0.05 wt% Mg-0.15 wt% Zr-0.40 wt% Cr. A 5500-g sputtered deposit of Cu-0.15 wt% Zr alloy, 12.29 mm (0.484 in.) average thickness in the fatigue specimen gage length, was provided to NASA on one of their substrates. Author

N74-27022# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF A THERMO-MECHANICAL TREATMENT IN THE METASTABLE AUSTENITIC PHASE ON THE MECHANICAL PROPERTIES OF A 35 NCB 16 TYPE STEEL
Y. Remillieux and G. Cizeron Aug. 1973 21 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (Paris), v. 69, no. 1, 1972 p 1-10
(RAE-Lib-Trans-1714; BR36913) Avail: NTIS HC $4.25

The ausforming treatment together with the subsequent tempering treatments has been compared with the conventional heat treatment for a 35 NCD 16 type steel. The mechanical properties were found to increase on ausforming at 500 C for deformations up to 40%, above which there was no further improvement. The microstructural changes were studied using thermo-magnetometry, X-ray analysis and electron microscopy. From these studies the increase in strength is attributed to a pre-precipitation phenomenon that takes place during the ausforming treatment which is dependent upon the degree of deformation. Author

N74-27023# Southampton Univ. (England). Inst. of Sound and Vibration Research.
BENDING INDUCED CRACK PROPAGATION IN BARE AND CLAD 4 PERCENT Cu-ALUMINIUM ALLOYS WITH REFERENCE TO ACOUSTICALLY PROPAGATED FATIGUE CRACKS
K. P. Byrne Aug. 1973 67 p refs
(ISVR-TR-61) Avail: NTIS HC $6.50

The crack propagation characteristics of bare and clad 4% Cu-aluminum alloys under low level bending loads at low and high load reversal rates were examined. A comparison was made with results obtained from extensional tests. Crack growth under sinusoidal and narrow band random loading was investigated and methods of relating the crack growth rates under these two forms of loading were examined. Author (ESRO)

N74-27024# European Space Research Organization, Paris (France).
INFLUENCE OF THE PRECIPITATION CONDITIONS ON THE FATIGUE FRACTURE SURFACE OF THE ALUMINIUM ALLOY 7075
Hans-Joachim Dudek May 1974 40 p refs Transl. into ENGLISH of "Einfluss des Ausscheidungszustandes auf die Ermuedungsbruchflaeche bei der Legierung AlZnMgCu 1.5" DLR-FB-73-100, DFVLR, 12 Aug. 1973
(ESRO-TT-51; DLR-FB-73-100) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 13 DM

A new type of fatigue fracture surface of the aluminium alloy 7075 is described. The properties of this fracture are very different from those of known fatigue fractures and are characterized by the obliquity of the fracture surface with respect to the load direction, crack growth from the center of the test piece outwards, the lack of fatigue striations, and the propagation of the crack along crystallographic planes and slip lines. After an investigation of the conditions in which this oblique fracture occurs, the experimental observations are interpreted with the help of the Stroh-Zener model. Author (ESRO)

N74-27025# Army Foreign Science and Technology Center, Charlottesville, Va.
SPECIES DIFFERENCES OF SAME-ELEMENT ATOMS IN THE LATTICE OF PURE METALS AND INTERMETALLIC COMPOUNDS
V. D. Melikhov and A. A. Presnyakov 29 Jan. 1974 9 p refs Transl. into ENGLISH from Tr. Akad. Nauk Kaz. SSR, Inst. Yadernoi Fiz. (Alma Ata), v. 9, 1969 p 57-61
(AD-776176; FSTC-HT-23-204-73) Avail: NTIS CSCL 11/6

Species differences of same-element atoms in gamma-brass type compounds and solid solutions are analyzed based on X-ray and neutron diffraction patterns. Coordination numbers, mean interatomic distances, and magnetic moments are given for the various copper and zinc atomic species. Displacement of certain metal atom species by other component species with thermal treatment is discussed. GRA

N74-27026# Dayton Univ. Research Inst., Ohio.
ENGINEERING DESIGN DATA FOR ALUMINUM ALLOY 2124-T851 THICK PLATE Technical Report, Aug. 1972 - Sep. 1973
Kim A. Fudge and Raymond E. Jones Jan. 1974 33 p refs
(Contract F33615-72-C-1282; AF Proj. 7381)
(AD-777177; UDRI-TR-73-63; AFML-TR-73-310) Avail: NTIS CSCL 11/6

Tensile, fracture, fatigue, fatigue crack growth, and stress corrosion properties for aluminum alloy 2124-T851 thick plate were determined. Material property comparisons were then drawn between the 2124-T851 alloy and its parent alloy, 2024, in the T851 condition. A comparison of the mechanical properties of aluminum alloy 2124-T851 and 2024-T851 revealed that the 2124-T851 alloy exhibited similar tensile properties with possibly less short transverse ductility, superior fracture toughness, comparable fatigue properties with slightly lower smooth fatigue resistance, and identical fatigue crack growth rates. The 2124-T851 alloy also demonstrated good stress corrosion resistance. (Modified author abstract) GRA

N74-27027# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THERMAL AND MECHANICAL EFFECTS ON THE CORROSION BEHAVIOR OF Ti-6 Al-4V Report for Jan. 1971 - Jan. 1972
Dennis L. Dull and Louis Raymond 31 Mar. 1974 32 p refs
(Contract F04701-73-C-0074)
(AD-777170; TR-0074(4250-10)-5; SAMSO-TR-74-73) Avail: NTIS CSCL 11/6

Anodic and cathodic polarization behaviors of Ti-6Al-4V were determined by potentiostatic and galvanostatic techniques in deaerated 1, 5, and 10N sulphuric acid solutions. In the active region metallurgical processing, which included cold rolling and thermal treatment, had no effect on the corrosion behavior. It is

suggested that a titanium hydride film exists on the titanium alloy surface. In the passive region plastic deformation resulting from cold rolling increased the passive current density; whereas crystallographic texturing had no effect. The introduction of an alpha prime phase, resulting from thermal treatment, produced an additional peak in the passive region. Author (GRA)

N74-27028# Army Construction Engineering Research Lab., Champaign, Ill.
MULTIPLE CONNECTIVITY AND THE J INTEGRAL OF FRACTURE MECHANICS
E. M. Honig, Jr. Apr. 1974 14 p refs
(DA Proj. 4DM-728012-A-OK1)
(AD-777544; CERL-TM-M-85) Avail: NTIS CSCL 11/6

The path independence of Rice's J integral has been clearly shown for an integration path lying in a simply connected region, in addition to the presumption of elasticity or deformation plasticity. Because welded metals may contain voids, such as cluster porosity and small cracks in the vicinity of a major crack tip in the weld zone, the question of path independence of the J integral in a multiply connected region is of considerable interest. The report shows that the J integral incurs a finite increment, at each increase in connectivity, with respect to the integral value at the next lower connectivity. GRA

N74-27029# Naval Intelligence Support Center, Washington, D.C. Translation Div.
HIGH STRENGTH MARAGING STEELS
M. D. Perkas and V. M. Kardonshii 21 Jan. 1974 28 p Transl. into ENGLISH from the publ. "Vysokoprochnye Martensitno-Stareyushchie Stali" (Moscow) 1970 25 p
(AD-777415; NISC-Trans-3503) Avail: NTIS CSCL 11/6

Reviews fracture, mechanical properties, stress corrosion and composition relations for maraging steel. GRA

N74-27030# Naval Intelligence Support Center, Washington, D.C. Translation Div.
INVESTIGATION OF THE TECHNOLOGICAL PLASTICITY OF Ti-Al AND Ti-Al-V ALLOYS
A. P. Atroshchenko, K. N. Bogoyavlenskii, and S. S. Ushkov 12 Sep. 1973 10 p Transl. into ENGLISH from Resp. Mezhvedomstvennyy Nauchno-Tekhn. Sb. (Kharkov), no. 6, 1971 p 46-53
(AD-777416; NISC-Trans-3458) Avail: NTIS CSCL 11/6

The investigation of the technological plasticity of titanium alloys -- aluminum and titanium -- aluminum -- vanadium consisted in the tensile testing of smooth specimens and the upset testing of cylindrical specimens under different temperatures. GRA

N74-27031# Naval Intelligence Support Center, Washington, D.C. Translation Div.
TITANIUM ALLOYS AND THEIR USES
I. I. Kornilov 1 Oct. 1973 7 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), no. 4, 1973 p 33-36
(AD-777421; NISC-Trans-3459) Avail: NTIS CSCL 11/6

The uses of titanium alloys are discussed along with the development of new alloys based on the structural form of titanium. F.O.S.

N74-27032# Naval Intelligence Support Center, Washington, D.C. Translation Div.
PROTECTION OF METALS (SELECTED TRANSLATIONS)
I. B. Valanovskii, Yu. M. Korovin, E. Ya. Lyublinskii, V. A. Kechin, and I. P. Vyatkin 24 Oct. 1973 10 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 8, no. 3, 1972 5 p
(AD-777422; NISC-Trans-3463) Avail: NTIS CSCL 11/6

Contents: Self-dissolution of stainless steels in crevices in sea water; Effect of cooling rates on the electrochemical properties of the protector alloy ML4VCh. GRA

N74-27033# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
LOCAL STRESS-STRAIN APPROACH TO CUMULATIVE FATIGUE DAMAGE ANALYSIS Final Report, 26 Sep. 1969 - 21 Jun. 1971
Jo Morrow, J. F. Martin, and N. E. Dowling Jan. 1974 80 p refs
(Contract N00156-70-C-1256)
(AD-777462; T/AM-379; UILU-ENG-74-6001) Avail: NTIS CSCL 11/6

A cumulative fatigue damage procedure for estimating the fatigue crack initiation life of notched structural members subjected to known load histories is outlined. This procedure assumes that a knowledge of the local cyclic stress-strain response of the metal at the most severely strained region in a member is sufficient to predict when a crack will form there. Some of the steps in this procedure that are of current interest and which are especially applicable to a local stress-strain approach are discussed. Alternative, approximate and/or abbreviated steps in the cumulative fatigue damage procedure are given wherever possible. Limitations of the method and areas where research is needed are pointed out. Cumulative fatigue test results for smooth specimens, notched plates and built-up box beams are compared to life calculations made using the local stress-strain approach. Cyclic deformation and fracture properties, used in the analysis, were obtained from tests on a limited number of axially loaded unnotched specimens. These examples indicate that a cumulative fatigue damage analysis based on the local stress-strain approach employing a minimum amount of materials test data can be used to make reasonable life estimates for members similar to many practical structural members. (Modified author abstract) GRA

N74-27034# Battelle Columbus Labs., Ohio.
RESEARCH ON SYNTHESIS OF HIGH-STRENGTH ALUMINUM ALLOYS, PART 2 Annual Progress Report, 1 Jul. 1972 - 31 Jul. 1973
A. R. Rosenfield, C. W. Price, C. J. Martin, D. N. Williams, and D. C. Rennen Jul. 1973 135 p refs Prepared in cooperation with Reynolds Metals Co., Richmond
(Contract F33615-71-C-1805; AF Proj. 7353)
(AD-777159; AFML-TR-72-199-Pt-2; APR-2) Avail: NTIS CSCL 11/6

The program is divided into two tasks. The objective of Task A is to optimize the properties of aluminum alloys by controlling the concentrations and sizes of the small, intermediate, and large precipitates. Systematic variations in chemistry and also in the homogenization and aging treatments have provided a range of concentrations and sizes of the various precipitates in a series of alloys based on the 7075 and 2024 alloy compositions. Procedures for fracture toughness measurements of thin sheet material have been developed. Fatigue tests have also been conducted. The objective of Task B is to develop a recrystallized microstructure in wrought high-strength aluminum alloys during hot working. The desired microstructure is being sought by control of hot-working conditions and also control of alloy composition. (Modified author abstract) GRA

N74-26807* Bell Aerospace Co., Buffalo, N.Y.
MICROSCOPIC INVESTIGATION OF CAVITATION EROSION DAMAGE IN METALS
J. V. Hackworth and W. F. Adler *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 54-61 (For availability see N74-26800 16-12)
CSCL 11D

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-27035* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF LAMINATING STRUCTURAL MEMBERS Patent
Wilbur C. Heier, inventor (to NASA) Issued 4 Jun. 1974 5 p Filed 20 Jun. 1972
(NASA-Case-XLA-11028-1; US-Patent-3,814,653; US-Patent-Appl-SN-219435; US-Patent-Class-156-285) Avail: US Patent Office CSCL 11D

A laminate is obtained by providing a lightweight core material,

such as a honeycombed plastic or metal, within the cavity defined by an annular mold cavity frame. Face sheets, which are to be bonded to the core material, are provided on opposite sides of the frame and extend over the frame, thus sealing the core material in the cavity. An adhesive is provided between the core material and the face sheets and the combined thickness of the core material and adhesive is a close fit within the opposed face sheets. A gas tight seal, such as an O-ring gasket, is provided between the frame and the face sheet members to form a gas tight cavity between the face sheet members and the frame. External heat and pressure are used to bond the face sheets to the core material. Gas pressure is introduced into the sealed cavity to minimize out-gasing of the adhesive.
Official Gazette of the U.S. Patent Office

N74-27036 Illinois Univ., Urbana.
PLASTIC LIMIT STRENGTH OF UNIDIRECTIONAL FIBER-REINFORCED COMPOSITES Ph.D. Thesis
Saurindranath Majumdar 1973 132 p
Avail: Univ. Microfilms Order No. 74-12096

Limit theorems of plasticity are applied to unidirectional fiber-reinforced composite materials to determine bounds to plastic limit conditions for the composite in average stress space. For this purpose a representative volume element (RVE), sufficiently large compared to the scale of inhomogeneity of the composite, is chosen, and analyzed by limit analysis methods. Average stresses and strain rates for the RVE are defined in terms of surface averaged tractions and velocities respectively. A sufficient condition is then derived which, when satisfied, renders the limit condition in average stress space unique. Procedures are discussed for determining bounds to these limit conditions. Examples are, however, given indicating how indiscriminate use of these bounds to limit analysis of composite structures can lead to erroneous results. Dissert. Abstr.

N74-27037* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTUMESCENT COMPOSITION, FOAMED PRODUCT PREPARED THEREWITH AND PROCESS FOR MAKING SAME Patent
Salvatore R. Riccitiello and John A. Parker, inventors (to NASA) Issued 25 Jun. 1974 5 p Filed 26 Dec. 1972 Continuation-in-part of US Patent Appl. SN-140946, filed 6 May 1971
(NASA-Case-ARC-10304-2; US-Patent-3,819,550; US-Patent-Appl-SN-318358; US-Patent-Class-260-2.5FP; US-Patent-Class-106-15FP; US-Patent-Class-102-105; US-Patent-Class-252-8.1; US-Patent-Class-252-62; US-Patent-Class-260-2R; US-Patent-Class-260-2.5R; US-Patent-Class-260-396N; US-Patent-Class-260-DIG.24; US-Patent-Appl-SN-140946) Avail: US Patent Office CSCL 11D

An intumescent composition and the foamed product prepared by heating the composition are provided. The composition comprises the reaction product of para-benzoquinone dioxime and a concentrated mineral acid such as sulfuric acid, phosphoric acid, and polyphosphoric acid. The composition is useful as an intumescent agent either by itself or when combined with other materials. A fire-resistant and heat-insulating composition is provided by heating the intumescent composition above its intumescent temperature.
Official Gazette of the U.S. Patent Office

N74-27038*# Lehigh Univ., Bethlehem, Pa.
ON THE BOUNDS FOR THE STRESS INTENSITY FACTOR IN LAMINATED COMPOSITES
F. Erdogan and G. D. Gupta Jul. 1973 14 p refs
(Grant NGR-39-007-011)
(NASA-CR-138664; TR-72-14) Avail: NTIS HC $4.00 CSCL 11D

An attempt was made to calculate the upper and lower bound for the stress intensity factor when crack tips are in the primary laminate, the buffer strips, and at the interfaces. The tests were made on boron-epoxy composites. Author

N74-27039*# North Carolina Agricultural and Technical State Univ., Greensboro. Mechanical Engineering Dept.
CREATION OF A CERAMICS HANDBOOK Quarterly Progress Report, 1 Mar. - 31 May 1974
William J. Craft and G. Juri Filatovs 31 May 1974 8 p refs
(Grant NGR-34-021-013)
(NASA-CR-138603; QPR-2) Avail: NTIS HC $4.00 CSCL 11D

A study was conducted to develop a ceramics handbook defining properties and parameters necessary for thermostructural design. Continuing efforts toward this goal, and in particular toward the evolution of a reliable predictor of fracture from current literature, are described. Author

N74-27040*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF RECRYSTALLIZATION AND DEVITRIFICATION OF LUNAR GLASS Final Report
Donald R. Ulrich Apr. 1974 58 p refs
(Contract NAS9-12654)
(NASA-CR-134307) Avail: NTIS HC $6.00 CSCL 11D

The technique of differential thermal analysis (DTA) was applied to the study of the Apollo 17 orange soil (74220,63) and the Apollo 16 glass coated anorthite (64455,21). These glasses show accentuated exotherms of strain relief in the annealing range which is indicative of rapid cooling. These are amenable to interpretation by comparison to the known history of synthetic glasses. Synthetic glasses were prepared whose similarity in behavior between the lunar glasses and their synthetic analogs is striking. Approximate rates of cooling of the lunar glasses were determined from comparative DTA of lunar and synthetic glasses and from the determination of the relation of strain relief in the annealing range to quench rate. At higher temperatures the glasses show exotherms of crystallization. The crystallization products associated with the exothermic reactions have been identified by X-ray diffraction and the surface morphologies developed by strain relief and crystallization have been characterized with scanning electron microscopy. Author

N74-27041# Joint Publications Research Service, Arlington, Va.
CERAMICS REINFORCED WITH SINGLE CRYSTALS OF MULLITE
D. M. Karpinos, V. M. Grosheva, Yu. I. Morozov, and A. I. Ilchenko 22 May 1974 7 p refs Transl. into ENGLISH from Steklo Keram. (Moscow), no. 3, 1974 p 26-27
(JPRS-62051) Avail: NTIS HC $4.00

Results of a study for reinforcing ceramic materials with filiform monocrystals are presented. Author

N74-27042*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
LARGE-DIAMETER CARBON-COMPOSITE MONOFILAMENTS Final Report
W. G. Bradshaw, P. C. Pinoli, and R. F. Karlak 1 May 1974 112 p refs
(Contract NAS3-16794)
(NASA-CR-134625; LMSC-D358951) Avail: NTIS HC $8.75 CSCL 11D

Large-diameter carbon composite monofilaments with high strength and high modulus were produced by pregging multifiber carbon bundles with suitable organic resins and pyrolysing them together. Two approaches were developed to increase the utilization of fiber tensile strength by minimizing stress concentration defects induced by dissimilar shrinkage during pyrolysis. These were matrix modification to improve char yield and strain-to-failure and fiber-matrix copyrolysis to alleviate matrix cracking. Highest tensile strength and modulus were obtained by heat treatments to 2873 K to match fiber and matrix strain-to-failure and develop maximum monofilament tensile-strength and elastic modulus. Author

N74-27043# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics.
QUANTITATIVE ANALYSIS OF GLASS-CERAMICS BY X-RAY DIFFRACTION
Michael A. Russak May 1974 23 p refs
(RM-585) Avail: NTIS HC $4.25

An X-ray powder diffraction technique similar to one used for determination of quartz content in industrial dusts has been applied in determining the weight fraction crystallinity of glass-ceramics. A suitable internal standard is mixed with a sample

material, and the weight fraction of the phase in question, X sub 1, is related linearly to the ratio I sub 1/I subs, where I sub 1 and I subs are the integrated intensities of selected diffraction peaks from the component of interest and the internal standard, respectively. The weight fraction of nepheline ($Na_2O.Al_2O_3.2SiO_2$) in partially devitrified glasses in the $Na_2O.Al_2O_3.SiO_2$ and $Na_2O.Al_2O_3.Nb_2O_5.SiO_2$ systems was determined and found to be in good agreement with determinations made by other analytical methods. This method is of particular value with glass-ceramics because it is rapid, independent of mass absorption of the sample, and, therefore, independent of other crystalline (or amorphous) phases present and accurate to + or - 4 percent. Author

N74-27044# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF THE STRUCTURE OF CARBON FIBERS USING THE SCANNING ELECTRON MICROSCOPE
A. S. Fialkov, B. N. Smirnov, N. V. Bondarenko, S. G. Zaichiko, N. V. Polyakova, V. A. Mikhailova, and A. I. Bazer Apr. 1974 8 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. (Riga), v. 5, 1972 p 925-926
(RAE-Lib-Trans-1752; BR41244) Avail: NTIS HC $4.00

A study has been made of the structure of carbon fibers from hydrocellulose and PAN after heat treatment in the temperature range 800-3000 C and of carbonized fibers from PAN after oxidation in air. It has been established that substantial change in surface structure takes place after heat treatment at a temperature of 2600 C or higher. Structural changes in carbonized fibers after different degrees of oxidation are shown. Data are also given on change of surface structure and the formation of porous structure in carbons during oxidation under defined conditions. Author

N74-27045# Rosenthal-Stemag, Technische Keramik AG, Selb (West Germany).
HIGH VOLTAGE INSULATORS FOR OUTDOOR USE MADE OF SYNTHETIC MATERIALS. PRODUCTION PROCESS AND TESTING [HOCHSPANNUNGSFREILUFTISO LATOREN AUS SYNTHETISCHEN CHEMIEWERSKTOFFEN. HERSTELLUNGSVERFAHREN UND ERPROBUNG]
Martin Kuhl Bonn Bundesmin. fuer Forsch. und Technol. Nov. 1973 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-73-15) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 8 DM

New methods to produce Langstab insulators made of a glass fiber rod of high dielectric strength with sheds of silicone rubber to be used in high voltage transmission lanes are detailed. The rod is drawn in a continuous procedure unceasingly, whereas the sheds are poured on one after the other. The influence of epoxy resins and hardeners with regard to utilization and quality of the hardened material was examined. Two fittings were developed to fix the insulators, and long time strength data was ascertained. Laboratory experiments and good rating of the insulators in overhead lines of 15 to 400 kV permit the use of further insulators on approval. Author (ESRO)

N74-27046# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
GLASSY CARBONS Semiannual Progress Report, 30 Jun. 1973 - 1 Jan. 1974
Edward E. Hucke Oct. 1974 109 p refs
(Contract DAHC15-71-C-0283; ARPA Order 1824)
(AD-776544; UMICH-010199) Avail: NTIS CSCL 11/2

Porous glassy carbons achieved by pyrolysis of flurfural alcohol resins can reproducibly and rapidly be produced in large sections with tailored properties of potential interest for mechanical, physical and chemical applications. Sections greater than three inches have been made in pyrolysis cycles of one day. Thermodynamic cell measurements of the configurational enthalpy and entropy difference between glassy carbons and graphite have shown that the fine structures of various glassy carbons are quite different and certainly not merely microcrystalline graphite. Small angle X-ray scattering measurements under improved experimental conditions have shown excellent agreement with other such work on commercial glassy carbon samples. A rather strong inverse relation exists between the compressive strength and electrical resistivity, reduced by calculation to eliminate all pores open to xylene, indicating that better layer perfection leads to higher strength. (Modified author abstract) GRA

N74-27047# Georgia Inst. of Tech., Atlanta.
METAL-GROWN OXIDE-METAL COMPOSITES Final Technical Report, 10 Jun. 1971 - 31 Dec. 1973
Alan T. Chapman, James F. Benzel, J. K. Cochran, Robert K. Feeney, and F. W. Ling Dec. 1973 235 p refs
(Contract DAAH01-71-C-1046; ARPA Order 1637)
(AD-776414; E18-604-6) Avail: NTIS CSCL 11/4

The research program was designed to develop melt-grown oxide-metal composite structures for high field electron emission testing. A variety of refractory oxide-metal mixtures (i.e. UO_2-W, stabilized ZrO_2 and HfO_2-W, UO_2-Ta, and the rare earth oxides of Gd_2O_3, Nd_2O_3 and La_2O_3-Mo and W) were successfully induction melted and unidirectionally solidified to form aligned metallic fibers embedded in the oxide matrix. Metal solubility in the molten oxides, control of the oxide stoichiometry and metal volatility were shown to be significant parameters controlling the successful composite growth in these systems. Emission measurements were performed with a variety of unusual emitter geometries, including metallic coated samples and structures designed to operate at low voltages (100V). Analysis of post-emission damage and emission performance were used to assess the probable failure mechanism limiting the current density and life of the oxide-metal cathode structures. (Modified author abstract) GRA

N74-27048# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
AN EXPERIMENTAL INVESTIGATION OF STRESS WAVES IN RODS OF A FIBER-REINFORCED COMPOSITE
Peter J. Arseneaux, Jr. Jun. 1973 68 p refs
(Contract DA-31-124-ARO(D)-358)
(AD-776402; TR-21; AROD-5606-18-E) Avail: NTIS CSCL 11/4

The propagation of pulses in square bars of glass-epoxy fiber reinforced material was observed experimentally. The fiber orientation was varied from parallel to perpendicular to the bar's axis. Phase velocities were compared with those predicted from taking an effective Young's modulus for the bar. Geometric dispersion was considered by examining sinusoidal vibrations of composite rods of circular cross-section. Dispersion curves were predicted based on a lateral inertia correction and measured using a resonance method. The experimental results are not very extensive but nevertheless sufficient for qualitative conclusions to be advanced. Damping measurements were taken from oscilloscope records of free oscillations of the round composite rods. (Modified author abstract) GRA

N74-27049# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DUET OF METAL AND PLASTIC
A. Ivakhnov 25 Mar. 1974 8 p Transl. into ENGLISH from Izv. (USSR), no. 252, 26 Oct. 1973 p 3
(AD-776922; FTD-HT-23-1250-74) Avail: NTIS CSCL 11/9

An outline is given of methods and devices for the application of polymers and polymer-metallic coverings to all kinds of materials and equipment to render them: anticorrosive, decorative, and more reliable. Data also cover antifriction properties and electrical insulation characteristics. E.H.W.

N74-27050# Aerospace Corp., El Segundo, Calif. Lab Operations.
EXPERIMENTS ON PULSE PROPAGATION IN AN OBLIQUELY LAMINATED COMPOSITE Technical Report, Aug. - Dec. 1973
Charles Sve and Seichi Okubo 31 Jan. 1974 31 p refs
(Contract F04701-73-C-0074)
(AD-777577; TR-0074(4240-10)-10) Avail: NTIS CSCL 11/4

Experimental results are presented for the linear elastic dynamic response of periodically laminated composites. A shock tube-capacitive transducer technique is used to determine the rear surface velocity history of three laminated samples that have different lamination angles and are subjected to a step pressure loading. Viscosity effects are discussed, and comparisons

are made with predictions based on previous theoretical work.
Author (GRA)

N74-27051# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CW LASER EFFECTS ON COMPOSITE MATERIALS
Ona R. Lyman Mar. 1974 21 p ref
(DA Proj. 1T1-61102-A-33)
(AD-777765; BRL-MR-2352) Avail: NTIS CSCL 11/4

Boron epoxy and graphite epoxy composite samples were irradiated with a CO2 Electric Discharge Laser with irradiances from about 700 W/sq cm. Penetration times for the various sample thicknesses as a function of irradiance were measured. Temperature measurements were made on the rear surface to determine if thermal conductivity properties have a significant role in the experimental measurements. Author (GRA)

N74-27052# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
PRELIMINARY REPORTS, MEMORANDA AND TECHNICAL NOTES OF THE MATERIALS RESEARCH COUNCIL SUMMER CONFERENCE, VOLUME 1
Edward E. Hucke Jul. 1973 695 p refs Conf. held at La Jolla, Calif., Jul. 1973
(Contract DAHC15-71-C-0253; ARPA Order 2341)
(AD-777743) Avail: NTIS CSCL 11/7

Presents complete papers and reports of work in progress which represent initial ideas, problem suggestions, position papers, and status reports. GRA

N74-27053# Honeywell, Inc., Bloomington, Minn. Corporate Research Center.
AN INVESTIGATION OF PLZT FOR INTEGRATED OPTICS Annual Technical Report, 5 Mar. - 31 Dec. 1973
D. Chen, N. Marzwell, and U. Bonne 28 Feb. 1974 123 p refs
(Contract N00014-73-C-0359)
(AD-777065; HR-45550) Avail: NTIS CSCL 11/2

A study of using the lanthanum modified lead zirconate-lead titanate ceramics (PLZT) for integrated optics applications was undertaken. Significant research results obtained to date can be summarized as follows: (1) The optical quality including the optical adsorption and scattering and the electro-optic properties of PLZT were measured. These results indicate that PLZT is suitable for integrated optics applications. (2) Epitaxial growth of PLZT thin films was obtained by chemical vapor transport and liquid phase epitaxy. The physical dimension of the films must be increased to allow waveguiding and the intended applications. (3) The refractive index of PLZT is strongly dependent on the La content and the Zr/Ti ratio. This makes the medium suitable for the in-diffusion or out-diffusion technique to achieve refractive index modification for waveguiding. Author (GRA)

N74-27054# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Civil Engineering.
CRACK TIP STRESS INTENSITY FACTORS IN FINITE ANISOTROPIC PLATES Technical Report, Jul. 1972 - Jul. 1973
Matthew D. Snyder and Thomas A. Cruse Wright-Patterson AFB, Ohio AFML Aug. 1973 129 p refs
(Contract F33615-73-C-5055; AF Proj. 7340)
(AD-777588; AFML-TR-73-209) Avail: NTIS CSCL 11/4

A numerical technique has been derived for determining stress intensity factors in cracked anisotropic plates of finite geometry. Using complex variable methods an exact solution is derived for the problem of unit loads applied to a cracked infinite anisotropic plate. This fundamental solution is used with the boundary-integral equation method for analysis of plates of finite geometry. Numerical results are obtained for center-cracked and double-edge cracked finite width tension specimens using material properties representative of a family of advanced fiber reinforced composite laminates. For these geometries the numerical results indicate that the isotropic stress intensity factor serves as a good approximation for anisotropic materials. Author (GRA)

N74-27055# Atlantic Research Corp., Alexandria, Va.
DEVELOPMENT OF HIGH TEMPERATURE RESISTANT MATERIALS FOR USE IN NAVAL ORDNANCE Final Report, 5 Jul. 1972 - 31 Dec. 1973
Bruno J. Macri 31 Dec. 1973 39 p refs
(Contract N00017-73-C-4306)
(AD-777122; TR-PL-10124-00-6) Avail: NTIS CSCL 11/4

An 18 inch vacuum furnace was designed, constructed and successfully tested. A 5.5 inch diameter Pyrostrand (a graphite composite) cylinder was fabricated. Pyrostrand samples were prepared and submitted for mechanical properties tests for rocket motor nozzles. GRA

N74-27056# Arizona Univ., Tucson. Optical Sciences Center.
PROPERTIES OF GLASSES IN SOME TERNARY SYSTEMS CONTAINING BaO AND SiO2
Given W. Cleek (NBS, Washington, D. C.) Sep. 1973 45 p refs Previously announced as COM-73-50840 Sponsored in part by NBS
(Contract F44620-69-C-0024; AF Proj. 7921)
(AD-777138; AFOSR-74-0480TR; LC-73-600135; NBS-Monograph-35; COM-73-50840) Avail: NTIS MF $1.45; SOD HC $0.70 as C13.44.135 CSCL 11/2

The glass forming regions in six ternary oxide systems containing BaO, SiO2, and a third oxide have been determined. The properties of the resulting glasses were measured and the results reported. The data on refractive indices, dispersions, and specific volumes were evaluated by computer methods in an attempt to identify substructures containing the cations present in the glasses. Author (GRA)

N74-27057# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
FAILURE PROCESSES IN METAL MATRIX COMPOSITES, PHASE 2 Final Report, 1 Oct. - 31 Dec. 1973
R. G. Carlson 7 Feb. 1974 35 p refs
(Contract F33615-72-C-1713)
(AD-777165; R73AEG502; AFML-TR-74-15) Avail: NTIS CSCL 11/4

Boron/Aluminum (B/Al) composite blades were consolidated and impacted by RTV birds. Failure responses were observed. The blade deflections as determined by high speed movies were compared with calculated values generated from and AFML model and gave good agreement. Analyses of the strain gage responses yield inherent stress levels, resonant frequencies and logarithmic decrement of these blades. Author (GRA)

N74-27058# Aerospace Corp., El Segundo, Calif.
SALT WATER CORROSION BEHAVIOR OF ALUMINUM-GRAPHITE COMPOSITE Technical Report, Apr. - Jun. 1973
E. George Kendall and Dennis L. Dull 29 Mar. 1974 18 p refs
(Contract F04701-73-C-0074)
(AD-777180; TR-0074(9250-03)-2; SAMSO-TR-74-67) Avail: NTIS CSCL 11/4

The corrosion behavior of an aluminum-graphite composite in a salt water solution has been investigated to qualitatively characterize the effect of galvanic coupling prevalent between the aluminum matrix and the graphite fibers. A comparison is made with aluminum-boron and with other materials joined to graphite blocks. Although the corrosion rate of the aluminum matrix is increased by the presence of the graphite fiber, the aluminum-graphite composite is only slightly more reactive than the aluminum-boron composite in the salt water solution.
Author (GRA)

N74-27059# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
FINITE-ELEMENT ANALYSIS OF EDGE EFFECTS IN ANGLE-PLY COMPOSITE LAMINATES Final Report
Thomas F. Neu 19 Mar. 1974 16 p refs
(AD-777654; NADC-74051-30) Avail: NTIS CSCL 11/4

A three-dimensional finite-element modelling and analysis technique has been developed and used in the evaluation of edge stresses in angle-ply composite laminates. Excellent results have been obtained for the initial application to a four-ply plus or minus 45 degrees laminate in tension and the method is potentially applicable to holes, notches and other boundaries of arbitrary geometry. Author (GRA)

N74-27060# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF HIGH-TEMPERATURE-RESISTANT ELASTOMERIC SEALANT Final Report, 12 Apr. - 30 Dec. 1973
A. E. Senear Apr. 1974 35 p refs
(Contract N00019-73-C-0293)
(AD-777699; D6-41518) Avail: NTIS CSCL 11/10

A program aimed at synthesizing hydrofluorocarbon-fluorosilicone or -silicone polymers is reported. The copolymers were desired as bases for formulating improved pressure sealants for advanced aircraft. The free radical catalyzed addition of hydrogen sulfide to vinylsilanes was investigated. The desired mercaptans could not be obtained; only sulfide formation was observed. A mercaptan-substituted acetoxysilane was synthesized and condensed with dehydrofluorinated Viton. Combination of this product with acetoxy-functional fluorosilicones could not be attempted due to the instability of the product. A low molecular weight dimethylsilicone with mercaptan end-groups was synthesized and used to cross-link dehydrofluorinated Viton. The copolymer formed was not suitable for sealant use. A hydrofluorocarbon-fluorosilicone cocured product, described previously, was investigated further. It was not suitable for sealant use. (Modified author abstract) GRA

N74-27061# Monsanto Research Corp., St. Louis, Mo.
THE DEPENDENCY OF COMPOSITE STRENGTH ON VOLUME FRACTION
M. J. Michno, Jr., E. M. Wu, and R. E. Lavengood Mar. 1974 30 p refs
(Contract N00014-67-C-0218)
(AD-777685; HPC-73-156) Avail: NTIS CSCL 11/4

The dependency of composite strength under combined normal stress has been experimentally determined as fiber content was varied over the range 40% less than or equal to v sub f less than or equal to 75%. Failure predictions of the tensor polynomial criterion agree well with experimental data in stress space. The maximum strain criterion predicts a physically inadmissible failure envelope in the stress space due to the assumed linear constitutive law. In strain space the maximum strain criterion compares favorably with experimental observation. GRA

N74-27062# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
THIRD PHASE FIBER ADDITION TO ADVANCED GRAPHITE COMPOSITES FOR IMPROVEMENT OF IMPACT STRENGTH Final Report, May 1973 - Mar. 1974
J. L. Perry, J. L. Kirkhart, and D. F. Adams 1 Mar. 1974 194 p refs
(Contract N00019-73-C-0389)
(AD-777074) Avail: NTIS CSCL 11/4

The objective of this program was to determine and characterize the load-time response behavior of advanced graphite composites during an impact loading environment. Two basic graphite fiber orientations were evaluated, composites in which the filament repeating unit direction is (1) 0 degree, and (2) 0 degree + 45 degrees, -45 degrees, 90 degrees. Hybrid configurations were also characterized. The hybrid configurations were fabricated using the basic graphite orientations with discrete amounts of supplementary third phase fibers added to the composites in 0 degree and in +45 degrees and -45 degrees directions. The third phase fibers evaluated were glass yarn, nylon yarn and PRD-49 Type III. Thin (0.080 in.) composite test panels were made as well as thick (0.5 in.) panels. GRA

N74-27063# Rockwell International Corp., McGregor, Tex. Rocketdyne Div.
INVESTIGATION OF FATIQUE AND CRACK PROPAGATION BEHAVIOR OF ADHESIVES Final Technical Report, Oct. 1972 - Sep. 1973
W. B. Jones, Jr. and D. H. Kaelble Dec. 1973 67 p refs
(Contract F33615-71-C-1502; AF Proj. 7340)
(AD-777178; R-4701-7; AFML-TR-72-218-Pt-2) Avail: NTIS CSCL 11/1

The exploratory research program was directed toward determination of fundamental material parameters descriptive of fracture behavior of adhesive joints. Both brittle and ductile adhesives were used and materials were chemically and mechanically characterized and surface properties measured. Extensive fracture testing was conducted to measure fracture energies under a variety of cyclic fatigue loading and chemical environments typically encountered by aircraft bond joints. (Modified author abstract) GRA

N74-27064# Stanford Research Inst., Menlo Park, Calif.
CERAMIC PROCESSING STUDIES IN MgAl2O4 SYSTEM Final Report, 18 Feb. 1971 - 18 Dec. 1973
Paul J. Jorgensen Jan. 1974 42 p refs
(Contract N00019-71-C-0246)
(AD-777068; SRI-PYU-1123-FR) Avail: NTIS CSCL 11/2

The final-stage sintering behavior or densification of MgAl2O4 has been studied as a function of stoichiometry in an attempt to inhibit grain growth by solute segregation to the grain boundaries and to allow spinel to sinter to theoretical density. It was found that the grain growth could be inhibited by deviations from stoichiometry, and that grain growth inhibition increased as the spinel composition approached the solid solubility limit in MgO-rich spinel. Changes in stoichiometry do not provide sufficient grain growth inhibition to prevent the occurrence of discontinuous grain growth. However, spinel can be sintered to theoretical density by a second-phase mechanism in which the second phase is MgO. The presence of the second phase in the spinel causes light scattering and results in a translucent material. (Modified author abstract) GRA

N74-26542 Joint Publications Research Service, Arlington, Va.
STUDY OF THE GAS EMANATION OF A NUMBER OF POLYMERS DURING THEIR PROLONGED STORAGE
A. I. Gorshunova and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 33-39 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 89-93 (For availability see N74-26527 16-04)

N74-26545 Joint Publications Research Service, Arlington, Va.
PHYSIOLOGIC AND HYGIENIC EVALUATION OF EXPERIMENTAL SAMPLES OF COSMETICS
V. V. Zhidkov, L. S. Belikova, V. P. Gorshkov, G. A. Shumilina, and G. N. Komzalova *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 44-46 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 111-113 (For availability see N74-26527 16-04)

N74-26552 Joint Publications Research Service, Arlington, Va.
STUDY OF VOLATILE SUBSTANCES RELEASED BY POLYMERS BASED ON POLYETHYLENE HALOGEN DERIVATIVES
Ye. V. Kolchina, V. D. Yablochkin, V. A. Shchirskaya, A. I. Gorshunova, and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 64-68 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 166-169 (For availability see N74-26527 16-04)

N74-26575 Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF VOLATILE SUBSTANCES RELEASED BY POLYMER CONSTRUCTION MATERIALS
V. D. Yablochkin, A. M. Popov, A. I. Gorshunova, V. A. Shchirskaya, Ye. V. Kolchina, and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 118-124 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 294-299 (For availability see N74-26527 16-04)

N74-26576 Joint Publications Research Service, Arlington, Va.
STUDY OF WAYS TO REDUCE TOXIC GAS EMANATION OF POLYMERS
V. D. Yablochkin *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 125 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 300 (For availability see N74-26527 16-04)

N74-26577 Joint Publications Research Service, Arlington, Va.
STUDY OF VOLATILE SUBSTANCES RELEASED BY

POLYMER CONSTRUCTION MATERIALS
V. D. Yablochkin, V. A. Shchirskaya, A. M. Popov, A. I. Gorshunova, Ye. V. Kolchina, and E. I. Chukhno *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 126-131 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologii i Meditsiny" Moscow, 1971 p 301-305 (For availability see N74-26527 16-04)

N74-26578 Joint Publications Research Service, Arlington, Va.
STUDY OF WAYS TO REDUCE THE TOXIC GAS RELEASE OF POLYMERS
V. D. Yablochkin and V. A. Shchirskaya *In its* Current Probl. in Space Biol. and Med. (JPRS-56499) 14 Jul. 1972 p 132-134 Transl. into ENGLISH from the publ. "Aktualnyye Voprosy Kosmicheskoy Biologi i Meditsiny" Moscow, 1971 p 305-308 (For availability see N74-26527 16-04)

N74-26813* Naval Air Development Center, Warminster, Pa.
POTENTIAL OF THIN, SPUTTERED FILMS AS EROSION RESISTANT PROTECTIVE COATINGS, PART 1
Konrad Gentner and James E. Newhart *In* NBS The role of Cavitation in Mech. Failures Apr. 1974 p 117-128 Prepared in cooperation with Naval Air Propulsion Test Center, Trenton (For availability see N74-26800 16-12)
CSCL 11D

N74-26815* Air Force Materials Lab., Wright-Patterson AFB, Ohio. Elastomers and Coatings Branch.
RAIN DROPLET EROSION MECHANISMS IN TRANSPARENT PLASTIC MATERIALS
George F. Schmitt, Jr. *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 146-159 refs (For availability see N74-26800 16-12)
CSCL 11D

N74-26816* Naval Air Development Center, Warminster, Pa. Aeronautical Electronics Technology Dept.
ANALYSIS OF NAVY RADOME FAILURE PROBLEMS
G. J. Tatnall and K. Foulke *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 160-165 (For availability see N74-26800 16-12)
CSCL 11D

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-27065*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
AN ANALYSIS OF THE ACCURACY OF A PARAMETER OPTIMIZATION M.S. Thesis
Yoram Baram Jan. 1974 98 p refs
(Grant NGL-22-009-548; DSR Proj. 73598)
(NASA-CR-138615; TE-54) Avail: NTIS HC $8.00 CSCL 12A

The numerical operations involved in a currently used optimization technique are discussed and analyzed with special attention to the numerical accuracy. Alternative methods for deriving linear system transfer functions, finding the relationships between the transfer function coefficients and the design parameters, and solving a matrix equation are presented for more accurate and cost effective solutions. A.A.D.

N74-27066*# Virginia Univ., Charlottesville. Research Labs. for Engineering Sciences.
LIMITING PERFORMANCE OF DYNAMIC SYSTEMS SUBJECT TO RANDOM INPUTS Final Report
Walter D. Pilkey and Bo Ping Wang Sep. 1973 38 p refs
(Grant NGR-47-005-145; Proj. 4085-2320)
(NASA-CR-138653; ESS-4085-110-73) Avail: NTIS HC $5.00 CSCL 12A

The problem of determining the limiting performance characteristics of mechanical systems subject to random input is studied. A review is presented of the classical work in the optimal design of stochastic systems. Some recent results of stochastic optimal control theory are employed. The solution to the limiting performance problem is formulated in both the frequency and time domains. Both formulations require substantial, burdensome computations when applied to large scale systems. Author

N74-27067# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CONFORMAL MAPPING AND GREEN FUNCTIONS
F. Oberhettinger, W. Magnus, and W. Blaschke, ed. May 1973 24 p refs Transl. into ENGLISH from the book "Die Grundlehren der Mathematischen Wissenschaften" v. 55, 1949 p 32-50 (NTC-74-50410; Rept-73-129) Avail: NTIS HC $4.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The mapping of the z-plane onto the lambda-plane is investigated using the imaginary transformation of Jacobi. The path described by the image point in the z-plane is discussed for rectangular, elliptical, and polygonal regions. F.O.S.

N74-27068*# California Univ., Berkeley. Electronics Research Lab.
ADVANCED THEORETICAL AND EXPERIMENTAL STUDIES IN AUTOMATIC CONTROL AND INFORMATION SYSTEMS Final Report
C. A. Desoer, E. Polak, and L. A. Zadeh 21 Mar. 1974 14 p refs
(Grant NGL-05-003-016)
(NASA-CR-138503) Avail: NTIS HC $4.00 CSCL 12A

A series of research projects is briefly summarized which includes investigations in the following areas: (1) mathematical programming problems for large system and infinite-dimensional spaces, (2) bounded-input bounded-output stability, (3) non-parametric approximations, and (4) differential games. A list of reports and papers which were published over the ten year period of research is included. D.L.G.

N74-27069*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
ON THE ERROR PROBABILITY OF GENERAL TREE AND TRELLIS CODES WITH APPLICATIONS TO SEQUENTIAL DECODING
Rolf Johannesson Dec. 1973 34 p refs Submitted for publication
(Grant NGL-15-004-026)
(NASA-CR-138609; TR-EE-7316) Avail: NTIS HC $4.75 CSCL 12A

An upper bound on the average error probability for maximum-likelihood decoding of the ensemble of random binary tree codes is derived and shown to be independent of the length of the tree. An upper bound on the average error probability for maximum-likelihood decoding of the ensemble of random L-branch binary trellis codes of rate $R = 1/n$ is derived which separates the effects of the tail length T and the memory length M of the code. It is shown that the bound is independent of the length L of the information sequence. This implication is investigated by computer simulations of sequential decoding utilizing the stack algorithm. These simulations confirm the implication and further suggest an empirical formula for the true undetected decoding error probability with sequential decoding. Author

N74-27070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A MONTE CARLO INVESTIGATION OF EXPERIMENTAL DATA REQUIREMENTS FOR FITTING POLYNOMIAL FUNCTIONS
George C. Canavos Washington Jun. 1974 21 p refs
(NASA-TN-D-7516; L-9127) Avail: NTIS HC $3.00 CSCL 12A

This report examines the extent to which sample size affects the accuracy of a low order polynomial approximation of an experimentally observed quantity and establishes a trend toward improvement in the accuracy of the approximation as a function of sample size. The task is made possible through a simulated analysis carried out by the Monte Carlo method, in which data are generated by using several transcendental or algebraic functions as models. Contaminated data of varying amounts are fitted to linear quadratic or cubic polynomials, and the behavior of the mean-squared error of the residual variance is determined

as a function of sample size. Results indicate that the effect of the size of the sample is significant only for relatively small sample sizes and diminishes drastically for moderate and large amounts of experimental data. Author

N74-27071# Research Inst. of National Defence, Stockholm (Sweden).
ESTIMATION OF LOCATION AND SCALE PARAMETERS FROM ORDERED SAMPLES, WITH NUMERICAL APPLICATION TO THE GUMBEL AND WEIBULL DISTRIBUTIONS. SUPPLEMENT 1: TABLES TO MEAN VALUES, VARIANCES, AND COVARIANCES OF THE ORDER STATISTICS FOR THE GUMBEL DISTRIBUTION FOR SAMPLE SIZES UP TO AND INCLUDING n=31
Arne Fransen Feb. 1974 102 p refs
(FOA-P-B-8027-M4; ISBN-91-7056-028-5) Avail: NTIS HC $8.25

The mean values, variances, and covariances of the order statistics for the Gumbel distribution for sample sizes up to and including n=31 are presented in decimal form with 50 places (not rounded-off). These values were used as basic material for calculating the coefficients for the best linear estimated values of location and scale parameters for the Weibull distribution using order statistics. Author

N74-27072# Research Inst. of National Defence, Stockholm (Sweden).
ESTIMATION OF LOCATION AND SCALE PARAMETERS FROM ORDERED SAMPLES, WITH NUMERICAL APPLICATION TO THE GUMBEL AND WEIBULL DISTRIBUTIONS. PART 2: SAMPLE SIZES UP TO n=31 INCLUSIVE, EFFICIENCY INVESTIGATION
Arne Fransen Feb. 1974 29 p refs
(FOA-P-B-8026-M4; ISBN-91-7056-027-7) Avail: NTIS HC $4.50

Calculations of the numerical values of the coefficients for estimated values of location and scale parameters for the Gumbel and Weibull distributions, using order statistics, are presented for sample sizes up to and including n=31. An efficiency investigation is included as well. The method used for calculating the covariances involves very highly precise values of the natural logarithms as well as of some dilogarithms. The values of these that are needed for the calculations are presented in two appendices. Author

N74-27073# Gesellschaft fuer Mathematik und Datenverabeitung, Bonn (West Germany).
USE OF COMPUTERS FOR THE SOLUTION OF NONLINEAR PARTIAL INTEGRO-DIFFERENTIAL EQUATIONS DEMONSTRATED IN A PROBLEM OF PLASMA PHYSICS [DER EINSATZ VON COMPUTERN BEI DER LOESUNG NICHTLINEARER, PARTIELLER INTEGRODIFFERENTIALGLEICHUNGEN DEMONSTRIERT AN EINEM BEISPIEL AUS DER PLASMAPHYSIK]
Reinhard Krichel 1973 27 p refs In GERMAN; ENGLISH summary
(GMD-Mitt-25) Avail: NTIS HC $4.50

A solution of a complicated, nonlinear partial integral differential equation which is impossible to find by usual analytical methods and without support of modern electronic computers is presented. The physical background of the mathematical problem of the transformation into a set of difference equations is discussed and mathematical conditions for convergence are stated. A mixture of relaxation methods for solving a system of hundreds of nonlinear difference equations simultaneously with numerical computation of integral expressions leads to a numerical technique. A flowchart of the method which corresponds closely to the FORTRAN language is given. There is no difficulty in using another language. Author (ESRO)

N74-27074# Gesellschaft fuer Mathematik und Datenverabeitung, Bonn (West Germany).
INTERPOLATION THEORY FOR BANACH SPACES: AN INTRODUCTORY REVIEW [INTERPOLATIONSTHEORIE FUER BANACHRAEUME. EINE EINFUEHRENDE UEBERSICHT]
Eckehard Gross 1974 31 p refs In GERMAN
(GMD-Mitt-26) Avail: NTIS HC $4.75

Interpolation theories for Banach spaces are reviewed. A general interpolation theory, based on the convexity theorems of M. Riesz and Marcinkiewicz, is discussed. Special interpretation methods, including the K- and J-methods of J. Peetre and the Calderon method, are presented. Special interpolation spaces such as Banach function spaces, spaces produced by operators, Besov spaces, and Bessel potential spaces are described. Extensions of the theories discussed are outlined. ESRO

N74-27075# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ON THE EXACT DISTRIBUTIONS OF THE TEST STATISTICS BASED ON THE EIGENVALUES OF COMPLEX RANDOM MATRICES
P. R. Krishnaiah Dec. 1973 26 p refs
(AF Proj. 7071)
(AD-776315; ARL-73-0178) Avail: NTIS CSCL 12/1

In the report, the author considers the derivation of the exact noncentral distributions of certain test statistics based upon the eigenvalues of a class of complex random matrices. This class of random matrices include Wishart matrix, MANOVA matrix, canonical correlation matrix and the two-sample covariance model matrix in the complex case. The moments of the elementary symmetric functions as well as the Laplace transformations of the traces of the above class of random matrices are derived. Also, the exact distributions of any few roots as well as the distributions of certain ratios of the roots of the above class of random matrices are derived. In addition, the exact noncentral distribution of the trace of the complex MANOVA matrix is derived. Author (GRA)

N74-27076# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SIMPLE, EFFICIENT CLOSED-FORM APPROXIMATIONS FOR BETA PERCENTILES, EXPONENTIAL PREDICTION INTERVALS AND CONFIDENCE BOUNDS ON EXPONENTIAL AND BINOMIAL PARAMETERS
N. R. Mann and F. E. Grubbs Feb. 1974 31 p refs
(DA Proj. 1T1-61102-A-14B)
(AD-775804; BRL-1700) Avail: NTIS CSCL 12/1

The use of Patnaik's (1949) Chi-square approximation to the non-central Chi-square distribution and the Wilson-Hilferty (1931) transformation of Chi-square to approximate normality are explored herein as a simple, efficient means of finding one-or-two-order statistic confidence bounds on parameters of the one- and two-parameter negative exponential distributions. Such methods can be used when it is known that r of n sample items, r < or = n, have failed during a life test, but the times of some early failures are not known exactly. An important implication of the result applying to approximate confidence bounds on the mean of an exponential distribution from a single order statistic is that of obtaining simple-closed-form approximations to percentiles of the Beta distribution (with integer parameters). It is shown that a generalization of the approximation applies to Beta variates with noninteger parameters. (Modified author abstract) GRA

N74-27077# Army Foreign Science and Technology Center, Charlottesville, Va.
EMPIRICAL METHOD OF SOLVING AN INTEGRAL EQUATION IN VISCO-ELASTICITY THEORY
A. A. Ilyushin 20 Dec. 1973 7 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), no. 4, 1969 p 584-587
(AD-776569; FSTC-HT-23-2445-72) Avail: NTIS CSCL 12/1

The paper presents the development of a method of improving the convergence of Il'yushin's method of approximations based on representing the relation between the solutions of problems in viscoelasticity theory and Poisson ratio in terms or rational functions, and on the combined use of creep and relaxation functions obtained experimentally. The method proposed consists in solving an integral equation in viscoelasticity theory on the basis of creep tests performed with a polymer sample containing an elastic element as an inclusion. GRA

N74-27078# Johns Hopkins Univ., Baltimore, Md. Dept. of Mathematical Sciences.
STATISTICAL TECHNIQUES FOR COMMUNICATION, TRACKING AND CONTROL Final Report, 1 Aug. 1972 -

31 Dec. 1973
David B. Duncan Mar. 1974 15 p refs
(Contract F44620-72-C-0094; AF Proj. 9769)
(AD-777182; AFOSR-74-D457TR) Avail: NTIS CSCL 12/1

The areas of research include (1) multiple comparisons, (2) adaptive trajectory estimation including adaptive linear dynamic recursive estimation for known and unknown variances, (3) binary time series, (4) weak convergence, and (5) variance estimation under linear regression models in finite population sampling theory. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-27079 Texas A&M Univ., College Station.
ON THE STRUCTURE AND DEVELOPMENT OF SEVERE LOCAL STORMS AS REVEALED BY DIGITAL RADAR OBSERVATIONS Ph.D. Thesis
Yates Julio Canipe 1973 159 p
Avail: Univ. Microfilms Order No. 74-13055

Analyses of severe local storms in Oklahoma on six days during 1969 through 1972 were performed with the use of digital radar data collected by the National Severe Storms Laboratory, and National Oceanic and Atmospheric Administration, Norman, Oklahoma. Three techniques of numerical analyses have been employed in this study: vertical integration of liquid water (VIL), partial vertical integration of liquid water (PVIL), and constant-altitude reflectivity maps (CAZM's). The CAZM's reveal clearly the four-dimensional characteristics of the severe, local, storm structure and development. The VIL maps provide a quick two-dimensional display which may prove to be an important tool for real-time forecasting of severe storms, but fail to reveal the necessary detail for post analysis. The PVIL maps provide an excellent blend with the quickness and simplicity of the VIL and most of the detail of the CAZM. Dissert. Abstr.

N74-27080 Stanford Univ., Calif.
A RADIO ACOUSTIC SOUNDING SYSTEM FOR REMOTE MEASUREMENT OF ATMOSPHERIC TEMPERATURE Ph.D. Thesis
Edgar Maxie North, Jr. 1974 102 p
Avail: Univ. Microfilms Order No. 74-13667

A new technique for remote measurement of temperature in the lower atmosphere was developed and successfully tested. The equipment used is called a radio acoustic sounding system because a burst of sound propagating upward in the air is tracked by a Doppler radar. Air temperature at sound pulse and a complete profile can be obtained in only a few seconds. In order to improve accuracy, the measurements are normally averaged for several minutes, but even so, the sampling rate is high enough to continuously monitor the temperature profile. Although earlier efforts showed that sound could indeed be tracked by radar, the work described is thought to be the first successful attempt to use the technique to measure temperature profiles.
Dissert. Abstr.

N74-27081# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
MEASURES FOR AIR QUALITY (1972 - 1973) Annual Report, FY 1973
James R. McNesby May 1974 145 p refs
(NBS-TN-828) Avail: SOD HC $1.70 as C13.46:828

A project-by-project description is presented of the Measures for Air Quality program covering the fiscal years 1972 and 1973. Although air pollution measurement sciences has formed the major thrust of the program, it was extended to include water pollution. The project reports include progress made during FY 72 for those FY 73 projects which were active in FY 72. Where a project was terminated at the end of FY 72 its description is included. In water pollution the situation is much more complex since there are many more pollutants in more types of water that will be subject to control under the Federal Water Pollution Control of 1972. When a pollutant is of concern in the discharge permit program, water quality standards, the toxic pollutant list in the specimen bank program, the state of the measurement art is scrutinized at NBS and the need for development assessed. Author

N74-27082# Miami Univ., Fla. Rosenstiel School of Marine and Atmospheric Science.
RADAR PARAMETERS FOR NOAA AIRCRAFT AND IMPROVING THE RADAR HURRICANE PRECIPITATION MODEL Final Report
H. V. Senn Feb. 1974 58 p refs
(Contract NOAA-03-3-022-90)
(UM-RSMAS-74007) Avail: NTIS HC $6.00

Several methods are explored for using quantized showery summer precipitation radar data to improve the estimates of radar precipitation data obtained years ago in hurricanes using one or more IEC levels. It is shown that while echo size does not seem to be related to echo intensity, the areas of light to moderate rain rates bear a constant relationship to each other. The data necessary to extend the system to higher rates are not abundant enough, nor is the reliability of the rain-rate estimates great enough to warrant their use on hurricane data. The further complicating effects of beam-filling and attenuation, even at 10-cm wavelengths, are shown, both as they might be used in the correction of past data and as they complicate the formulation of specifications for a new generation of airborne research radar equipment. The radar video tape recording experiment performed during the 1973 season is summarized. Radar parameters for NOAA aircraft are discussed. Author

N74-27083*# Naval Postgraduate School, Monterey, Calif.
THE 1973 VARIATIONS OF HURRICANE HEAT POTENTIAL IN THE PHILIPPINE SEA AND THE GULF OF MEXICO M.S. Thesis
Paul Dennis Shuman Mar. 1974 112 p refs
(NASA Order T-4650-B)
(NASA-CR-138662) Avail: NTIS HC $8.75 CSCL 04B

The 1973 summer growth of hurricane heat potential (HHP) and its relation to tropical cyclones was studied in the Philippine Sea and the Gulf of Mexico on a monthly basis. BT information was processed through the Fleet Numerical Weather Central CDC 6500 computer to output maps of HHP, which were hand contoured. Inadequate data coverage and questionable BT observations resulted in monthly maps of varying validity and areal extent. HHP values peaked near 35,000 cal/sq cm-column in the Gulf of Mexico and 40,000 cal/sq cm-column in the Philippine Sea in the months of August and September, the months of highest tropical storm activity. In the Gulf of Mexico the 1973 HHP maximum-minimum values compared well with the HHP values obtained in August 1965-1968 by Leipper and Volgenau. HHP values from the Philippine Sea were in close agreement with the atlas values computed by Heffernan. Maximum values for 1973 were slightly (5000 cal/sq cm) higher. Some evidence was found correlating rises in HHP with increases in typhoon maximum wind speed. Author

N74-27084# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
A NUMERICAL EXPERIMENT ON THE PREDICTION OF THE NORTHEAST (WINTER) MONSOON IN SOUTHEAST ASIA
Robert W. Jones Jun. 1973 62 p refs
(NOAA-TR-ERL-272-WMPO-3) Avail: SOD HC $0.90

A nine-level primitive equation model with a boundary layer, orography, and stability dependent vertical diffusion was designed to predict the surge of the northeast monsoon. Forward time and upstream space differences are used in a semi-implicit integration system; Neuman conditions are given on the lateral boundaries at 0 and 64 deg N and 90 and 140 deg E; and a 2 deg latitude-longitude mesh is used. The model was tested with climatological data for January and synoptic data for 4 and 29 January 1970. The climatological forecast was a qualified success and a surge occurs. Lowest mode internal gravity waves form near 30 deg N and propagate southward as fast as 50 m/sec, contributing significant increases to the surface wind surge and providing a mechanism for southward propagation of the surge faster than advective speeds. Author

N74-27085*# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
PROPOSED MECHANISM OF TORNADO FORMATION FROM ROTATING THUNDERSTORMS
T. Theodore Fujita Oct. 1973 8 p refs Reprinted from the 8th Conf. on Severe Local Storms, 15-17 Oct. 1973
(Grants NGR-14-001-008; NOAA-E198-68(G))
(NASA-CR-138519; SMRP-RP-111) Avail: NTIS HC $4.00 CSCL 04B

Damage path statistics for some of the most destructive tornadoes in U.S. history are cited. Storm intensity and widths obtained from aerial photographs are used to develop a concept of tornado formation directly related to the phenomenon of family tornadoes. Hook-echo cells are described in terms of vertical structure, cloud axis, and three-dimensional air flow. Vorticity rates and the traveling mechanisms of rotating thunderstorms are discussed, and schematic diagrams are shown of the advancing stages of tornado production. Rotational and pulsation characteristics, and boundary layer stability during tornadoes are discussed, and recommendations are made for further comprehensive satellite observation. A.A.D.

N74-27086*# Chicago Univ., Ill.
OVERSHOOTING THUNDERHEADS OBSERVED FROM ATS AND LEARJET
T. Theodore Fujita Jan. 1974 31 p refs
(Grants NGR-14-001-008; NOAA-04-4-158-1)
(NASA-CR-138595; SMRP-RP-117) Avail: NTIS HC $4.75 CSCL 04B

Overshooting tops of thunderstorms were photographed simultaneously from both ATS and a Learjet during the cloud-truth experiment over the Midwest in the Spring of 1972 and 1973. The characteristics of overshooting tops were studied in various time and space scales, revealing that the horizontal dimensions of overshooting tops vary between 1000 ft and about 10 miles. The period of overshooting turrets with horizontal dimensions of less than 1 mile is found to be comparable to the Brunt-Vaisalla frequency of gravity waves at the lowermost stratosphere. The up-and-down motion of an overshooting dome, consisting of a number of turrets, is much slower than that of individual turrets. It is assumed that the height of a dome is closely related to the intensity of the up and downdrafts beneath the dome. Emphasis is placed upon the importance of the investigation of overshooting domes toward the identification of severe storm characteristics from satellites. Author

N74-27087*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE-TRACKED CUMULUS VELOCITIES
T. Theodore Fujita (Chicago Univ.), Edward W. Pearl (Chicago Univ.), and William E. Shenk Chicago Chicago Univ. Dec. 1973 21 p refs Prepared in cooperation with Chicago Univ.
(Grants NGR-14-001-008; E-198-68G; NSF GA-31589)
(NASA-TM-X-70088; SMRP-RP-114) Avail: NTIS HC $4.25 CSCL 04B

The research indicates that extreme caution must be exercised in converting cloud velocities into winds. The motion of fair-weather cumuli obtained by tracking their shadows over Springfield, Missouri revealed that the standard deviation in the individual cloud motion is several times the tracking error. The motion of over-ocean cumuli near Barbados clearly indicated the complicated nature of cumulus velocities. Analysis of whole-sky images obtained near Tampa, Florida failed to show significant continuity and stability of cumulus plumes, less than 0.3 mile in diameter. Cumulus turrets with 0.3 to 2 mile in size appear to be the best target to infer the mean wind within the subcloud layers. Cumulus or stratocumulus cells consisting of x number of turrets do not always move with wind. The addition and deletion of turrets belonging to a specific cell appear to be the cause of the erratic motion of a tracer cell. It may by concluded that the accuracy of wind estimates is unlikely to be better than 2m/sec unless the physical and dynamical characteristics of cumulus motion is futher investigated. Author

N74-27088# Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center.
AIR POLLUTION FROM MOTOR VEHICLES Final Report
[1973] 201 p refs Transl. into ENGLISH of Swed. Min. of Commun. Report, 1971
(APTIC-41654) Avail: NTIS HC $13.25

A summary of five years of developmental work on motor vehicle exhaust gases is presented. Based on the acquired experience, suggestions are presented for strengthening the Swedish regulations concerning vehicle exhaust gases, etc., and for the direction of the continued work in the field of motor vehicle exhaust gases. Author

N74-27089# Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center.
AIR POLLUTION FROM MOTOR VEHICLES, APPENDICES Appendix to Final Report
[1973] 93 p refs Transl. into ENGLISH of Swed. Min. of Commun. Report, 1971
(APTIC-41655-App) Avail: NTIS HC $7.75
For abstract, see N74-27088.

N74-27090# Bureau of Reclamation, Denver, Colo.
PROCEEDINGS: SKYWATER CONFERENCE 8. REVIEW OF CONCEPTUAL PLAN FOR A HIGH PLAINS COOPERATIVE PROGRAM, WITH APPENDIX: WRITTEN COMMENTS ON CONCEPTUAL PLAN AND STATEMENTS OF INTEREST
Mar. 1974 344 p refs Conf. held in Denver, 25-26 Jun. 1973
Avail: NTIS HC $20.25

The proceedings are reported of the High Plain Skywater Conference on weather modification. Background and concepts, the scientific hypothesis and planning considerations are discussed along with measurement systems, environmental impacts, and atmospheric models. F.O.S.

N74-27091# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management.
CONCEPTUAL PLAN FOR A HIGH PLAINS COOPERATIVE PROGRAM
May 1973 58 p
Avail: NTIS HC $6.00

Weather modification is discussed for providing more rainfall in the high plains states. Seeding methods for cumulus clouds, impacts of cloud seeding, objectives, evaluation techniques and policies of an extensive 5- to 7-year program are examined along with a management approach, and cost estimates. F.O.S.

N74-27092# Bonn Univ. (West Germany). Inst. fuer Meteorologie.
CLIMATOLOGICAL RESEARCH
Ferd. Duemmler's Verlag Nov. 1973 622 p refs Partly in ENGLISH; partly in GERMAN; ENGLISH summaries
(Bonn-Mi-17-1973) Avail: NTIS HC $34.25

Papers are presented in several areas of climatology, including atmospheric circulation, energy budgets and macroclimate, upper atmosphere effects, weather and climate in the tropics, synoptic climatology, local climatic phenomena, climate variations, and statistical methods. For individual titles, see N74-27093 through N74-27138.

N74-27093 Mainz Univ. (West Germany). Inst. fuer Meteorologie.
THE RESISTANCE LAWS IN THE PLANETARY BOUNDARY LAYER WITH ARBITRARY STRATIFICATION
K. Hinkelmann *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 1-9 In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

The resistance laws of the planetary boundary layer are deduced following the proposal by Blackhadar by matching profile functions, resulting from the similarity theory of Monin-Obukhov within the Prandtl layer, with corresponding profile functions, considered to be correct within whole boundary layer but with sufficient distance from the roughness height. Barotropy must not be assumed. To conserve one-parametric universal functions in the resistance laws, the external parameters must be read off from a layer of constant nondimensional height, i.e. from a layer variable with x, y, and t, which has to be determined by the resistance laws themselves, preferably by iterative processes.
Author (ESRO)

N74-27094 Colorado State Univ., Fort Collins.
A MULTIVARIATE TREATMENT OF KINETIC ENERGY
Elmar R. Reiter *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 11-20 refs (For availability see N74-27092 16-20)
(Contract AT(11-1)-1340)
(COO-1340-25)

Mean and eddy motions of the atmosphere are defined in terms of averages and departures from these averages with respect to time, pressure coordinate, and longitude. A breakdown of kinetic energy in such a multivariate treatment is presented. Suggestions are made to include the frequency space of atmospheric eddy motions into such a treatment.
Author (ESRO)

N74-27095 Wien Univ. (Austria). Lehrkanzel fuer Theoretische Meteorologie.
A THEORY OF NON-LINEAR CYCLOGENESIS
H. Reuter and H. Pichler (Innsbruck Univ.) *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 21-31 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

A scale analysis using Ro- and Ri-numbers of a given scale offers an estimate of the partition of the divergent, rotational and solenoidal terms in the vorticity production. The rotational and solenoidal terms become negligibly small compared with the divergent terms, if the scaling parameters (horizontal length, vertical depth and characteristics velocity) are defined as usual. This result disagrees with practical experience and theory of cyclogenetic process, i.e. the conventional method, taking the characteristic velocity as the average velocity of the scale space under consideration, does not lead to a satisfactory solution of the problem. Especially the characteristical field parameters of a jet stream cannot be represented by such a procedure. However the Ro- and Ri-numbers are adequately determined considering the maximum wind speed and horizontal and vertical wind shear. This is shown using an actual synoptic situation. Author (ESRO)

N74-27096 Technische Hochschule, Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.
ON THE THERMAL ASYMMETRY OF THE ATMOSPHERIC CIRCULATION
Frank Schmidt *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 33-40 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

The thermal equator at the surface has been observed to be displaced from the geographical equator position; this also applies to the annual mean, whereby the circulation structures of the two hemispheres are different. Futhermore, longitudinally dependent contrasts of land and sea bring about different displacements of this thermal equator and, by these, differences of the tropical wind structures of the troposphere. To simulate these asymmetries, forcing surface temperature profiles that are only latitudinally dependent and something like a simply longitudinally dependent distribution of land and sea have been introduced to a spectral model based on the primitive equations. The land-sea distribution has been characterized by different temperature profiles, heat capacities, and coefficients of exchange and surface friction for land and sea. Three series of experiments with either symmetrical temperature forcing and homogeneous surface of the earth or asymmetric forcing and homogeneous surface, or asymmetric forcing and a distribution of land and sea, gave a useful key for further studies.
Author (ESRO)

N74-27097 Institut Royal Meteorologique de Belgique, Brussels.
CHOICE OF THE AVERAGING OPERATOR IN ATMOSPHERIC TURBULENCE THEORY
J. VanMieghem *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 41-44 refs (For availability see N74-27092 16-20)

A method for conducting a numerical analysis of atmospheric turbulence is discussed. In atmospheric dynamics, the values considered are generally period, line or area averages. The average value of an arbitrary meteorological parameter over a certain space-time domain is the integral of the parameter over this domain divided by its measure. Having chosen a space-time domain of a certain scale, the average mass distribution is defined by the mean value of the air density for the domain and the average air motion by the corresponding weighted mean value of the air velocity. Author (ESRO)

N74-27098 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
THE ANNUAL COURSE OF THE BAROTROPIC HORIZONTAL MASS TRANSPORTS IN THE INDIAN OCEAN
Werner Wergen and Michael Hantel *In its* Climatolog. Res. Nov. 1973 p 45-62 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

Stommel's (1948) vorticity equation for the barotropic oceanic mass-transport has been integrated numerically for the Indian Ocean on a 2 by 2 deg grid. Values of the wind stress curl at the sea surface have been obtained from Hantel's (1970) maps which are based on the 100 years of surface wind observations of the 'Dutch Atlas' (1952). The calculated patterns for the months January, April, July and October are compared with the observed surface currents. Best simulation is generally obtained for 10 to the minus 6th power per second where k is the bottom friction parameter. This figure yields, according to b = 2k/beta a model width of the Somali Current of b approximately 100 km in accordance with observations. The formula shows that, for the chosen grid scale, smaller k-values cannot resolve the boundary current and, therefore, are physically improper. A quantitative comparison with measured values of the mass-transport in the Somali Current during summer 1964 (Swallow and Bruce, 1966) shows satisfactory agreement in general though the calculated values are too low at some grid points. The relations of model calculations of this type to problems of sea-air interaction are discussed. Author (ESRO)

N74-27099 Kiel Univ. (West Germany). Abteilung Meteorologie.
SOURCES AND SINKS AT THE VERTICAL AND MERIDIONAL FLUXES OF THE TURBULENT KINETIC ENERGY IN TROPO- AND LOWER STRATOSPHERE OF 12 DECEMBER. 1957, IN WAVENUMBER DOMAIN
Klaus Arpe and Friedrich Defant *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 63-92 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

Based on detailed synoptic analyses of the mass field for selected isobaric surfaces of the tropo and lower stratosphere for Dec. 12, 1957, oo GMT (IGY) between latitude 40 deg N and the Northpole and based on the a subsequent computation of the windfield, a budget of the kinetic energy of the large scale turbulent motion has been determined. The field of sources and sinks of this kind of energy and its distribution in a mean meridional cross section was determined. Furthermore the fluxes of turbulent kinetic energy reguired to obtain a stationary state have been evaluated. Thereby the interaction between tropo and lower stratosphere was investigated. Computations are based on zonal harmonics and therefore the participation in these energetical processes of the standing long waves and that of the transient Rossby and cyclone waves is obtained.
Author (ESRO)

N74-27100 Wisconsin Univ., Milwaukee. Dept. of Geography.
SPATIAL ANALYSIS OF THE SEASONAL VARIABILITY OF MERIODIONAL EXCHANGE AS INDICATED IN MONTHLY MAPS OF THE 500 mb-SURFACE
Karel Bayer and Vera Bayer *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 93-109 refs (For availability see N74-27092 16-20)

The segments with prevailing northern and southern components of geostrophic winds were determined at 70 deg N. Comparison with similar segments at 50 deg N resulted in a determination of natural region of outflow pattern from the polar cap. The study represents a complementary investigation to the solution of natural seasons. Author (ESRO)

N74-27101 Main Geophysical Observatory, Leningrad (USSR).
THE HEAT BALANCE OF THE ARCTIC
M. I. Budyko *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 111-117 refs (For availability see N74-27092 16-20)

Determination of all the components of the arctic heat balance has been made possible in recent years through observations from drifting stations. This permitted the compilation of normal values of the balance components for a number of Arctic regions. The annual march of mean conditions for the Central

Arctic (approximately 80 deg N is discussed. The high albedo of ice surfaces (0.7-0.8) causes a weakly negative annual average of radiation balance. This figure is not very much influenced by the heat exchange on the surface of water leads. The heat balance of the earth-atmosphere system is presented on the basis of satellite data (global arctic albedo 0.62) and theoretical values; the radiation balance of the system is in all months negative. The energy necessary for climatic balance is provided by an advective income of heat from lower latitudes.
Author (ESRO)

N74-27102 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
ON THE SIMULATION OF THE GENERAL CIRCULATION OF THE ATMOSPHERE WITH NUMERICAL MODELS
G. Fischer *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 119-136 refs In GERMAN; ENGLISH summary Presented at the Meteorologentagung, Essen, Sep. 1971 (For availability see N74-27092 16-20)

A brief presentation of several aspects of general circulation calculations is given. These numerical experiments standing on an objective mathematical and physical basis offer a powerful tool to answer the important question in how far background processes - such as global air pollution - may affect our weather and climate. The inherent and inevitable error sources in these models are discussed. Fundamental properties of the atmospheric circulation are recalled followed by an explanation of the numerical models currently in use. Some interesting results are summarized and diagrams of the budgets of kinetic energy and zonal angular momentum are displayed. Author (ESRO)

N74-27103 Western Australia Univ., Nedlands.
EPITROPICAL CLIMATOLOGY OF THE SUBTROPICAL JET STREAM
Joseph Gentilli *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 137-165 refs (For availability see N74-27092 16-20)

The occurrence of epitropical rains in Australia and its relation to the subtropical jet stream April-June was investigated. A comparison with other continents so far shows that this phenomenon is peculiar to Australia. It is inferred that the absence in South America and southern Africa is due to the cool ocean waters offshore, while the pressure in Australia is due to the warm coastal waters at this time of the year, which provide a ready reservoir of vapor. Convergence around the 500-mbar level is the immediate cause of the rains. ESRO

N74-27104 Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
A STATISTICAL ANALYSIS OF FACTORS INFLUENCING THE WIND VEERING IN THE PLANETARY BOUNDARY LAYER
William M. Gray and Bruce R. Mendenhall (Meteorol. Intern. Inc.) *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 167-194 refs Sponsored by NSF (For availability see N74-27092 16-20)

Despite the general applicability of classical Ekman theory, individual observations of wind veering in the planetary boundary layer seldom exhibit the typical spiral turning with height. The reasons for these deviations from theory which occur not only as large fluctuations in time but also as significant differences in mean profiles from one location to another, are assessed. The magnitude of the short-term eddy fluctuations is large in comparison to average frictional veering. A statistical analysis of sufficiently long periods of observational data is made in order to eliminate these small-scale variations. An assessment of the large-scale veering parameters is then possible. Wind tower and conventional rawinsonde veering data of three to five year periods from various land and ocean stations are objectively analyzed. Average wind profiles and statistics of the individual observations in the lowest two kilometers are computed in order to determine which parameters significantly affect frictional wind veering. Corrections to observed veering are made for the horizontal temperature gradient (rotation of the pressure gradient with height) and for variations of thermal stability. The relative importance of these corrections and the nature of their variability in different climatic regions are discussed. After statistically eliminating the unsteady effects and applying corrections for horizontal and vertical temperature gradients, a more realistic spiral is obtained at each station. Author (ESRO)

N74-27105 Ohio State Univ., Columbus. Inst. of Polar Studies.
POLAR DRY DESERTS
Fritz Loewe *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 195-208 refs (For availability see N74-27092 16-20)

Polar dry deserts are ice-free regions in high latitudes in which the lack of vegetation is not solely due to cold but also to the very small precipitation. Such regions are found in the interior of Peary Land in northeast Greenland and in the Dry Valleys of southern Victoria Land in the Antarctic. The climates are described of two representative places. Bronlund Hus and Lake Vanda. These polar dry desert areas have surface features similar to those of warm deserts. Special consideration is given to the saline warm lakes of the Dry Valleys. Author (ESRO)

N74-27106 Bonn Univ. (West Germany). Inst. fuer Geographie.
THE BACKBONE OF AFRICA AND THE MAIN AFRICAN CLIMATIC DIVIDE (COMMENTS ON A MAP)
Carl Troll *In its* Climatolog. Res. Nov. 1973 p 209-222 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

A nearly continuous series of highlands traverses the eastern part of Africa, from the Red Sea Hills in Sudan to the Table Mount above Capetown, the so-called Backbone of Africa. Their exposure to the prevailing wind systems effects sharp climatic limits between the luff- and lee-side which join together to the most important climatic divide of the continent. The three-dimensional arrangements of climates, vegetation and landscape types depend on these facts. Author (ESRO)

N74-27107 National Center for Atmospheric Research, Boulder, Colo. Lab. of Atmospheric Sciences.
A DESCRIPTION OF THE GEOSTROPHIC WIND IN THE SOUTHERN HEMISPHERE
Harry VanLoon *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 223-237 refs Sponsored by NSF (For availability see N74-27092 16-20)

The main features of the winds in the Southern Hemisphere are described by means of geostrophic winds which have been computed from monthly mean maps of heights of standard pressure levels between sea level and 100 mb, and from daily maps of the 500-mb surface. Author (ESRO)

N74-27108 Hosei Univ., Tokyo (Japan). Dept. of Geography.
MORPHOLOGY OF THE TOPOGRAPHY AT THE 50 mb-LEVEL IN THE NORTHERN HEMISPHERE
Masatoshi M. Yoshino *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 239-251 refs (For availability see N74-27092 16-20)

Using the monthly mean topography charts of the 50 mb-level in the Northern Hemisphere from 1956 to 1965 the area of the polar night vortex within the 20,000 gpm contour line was measured for every month. The area reaches maximum, 35 million sq km, in January. It is indicated that the areas do show close relations to the topography patterns classified in a preceding study. For instance, the most striking winter type, Type-W3 prevails in January and February of the even years, whereas another winter type with the middle latitude anticyclones located south 40 deg N, Type-W2 develops in the odd years. The areas in the case of Type-W3 are 5 to 7 million sq km larger than those of Type-W2 on the average. Other aspects on seasonal change of the area and relations to some other conditions such as temperature in the lower stratosphere and the circulation patterns at the 500 mb-level are discussed. Author (ESRO)

N74-27109 Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Ionosphaerephysik.
COUPLING PHENOMENA BETWEEN LOWER AND UPPER ATMOSPHERE
W. Dieminger *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 253-262 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

No control of weather by events on the ionosphere has been observed so far nor is it likely because of the energy budget. To the contrary two phenomena were detected where a meteorological control of ionospheric phenomena is very probable. On the one side the winter anomaly of ionospheric absorption coincides with the period when stratospheric warming occurs

although there is no direct correlation. Probably it is caused by the advection of minor constituents of the atmosphere with a low ionization potential or a reduced loss rate of the electrons. On the other side periodic variations of the height of reflection in the F-region seem to be produced by infrasonic (gravity-) waves originating in severe thunderstorms. Author (ESRO)

N74-27110 National Center for Atmospheric Research, Boulder, Colo. Advanced Study Program.
LONG TERM VARIATIONS IN NOCTILUCENT CLOUD ACTIVITY AND THEIR POSSIBLE CAUSE
Benson Fogle and Bernhard Haurwitz *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 263-276 refs Sponsored by NSF (For availability see N74-27092 16-20)

Analysis of NLC data from 1885 - 1970 shows several periods of enhanced activity. During such periods, NLC were generally brighter, more extensive, of longer duration, and much more frequent than during quiescent periods. These periods of enhancement show no persistent relationship with solar, cometary, or meteor activity, but each was preceded by an explosive volcanic eruption of the Plinian type and/or multimegaton nuclear weapons tests in the troposphere, both of which inject or entrain large quantities of water vapor into the stratosphere. Transport of this moisture-enriched stratospheric air to the high-latitude summer mesosphere by means of the circulation system proposed by Hesstvedt could increase the water vapor concentration there, leading to increased NLC activity, if NLC particles are ice, as now seems likely from recent sampling experiment results.
Author (ESRO)

N74-27111 Bonn Univ. (West Germany). Inst. fuer Astronomie.
THE ATTENUATION OF ACOUSTIC-GRAVITY WAVES WITHIN THE THERMOSPHERE
H. Volland *In its* Climatolog. Res. Nov. 1973 p 277-296 refs (For availability see N74-27092 16-20)

It is shown that dissipation of acoustic-gravity energy within thermospheric heights results predominantly from heat conduction and ion drag. Viscosity has no significant influence on the propagation characteristics of acoustic-gravity waves in a wide range of frequencies which includes the range where acoustic and gravity waves are observed. Due to ion drag, the influence of the Coriolis force on wave propagation is also drastically reduced at thermospheric heights. The thermosphere reacts like a filter with respect to gravity waves allowing optimum propagation at frequencies omega approx. 0.7 omega b and at horizontal wave numbers k sub x approximately equal to omega b divided by C where omega b is the Brunt-Vaisala-frequency and C is the velocity of sound. The observed ranges of horizontal wavelengths and of quasi-periods of travelling ionspheric disturbances, of gravity waves, and of infrasound waves fit well in with the theoretical predictions of optimum wave propagation. Author (ESRO)

N74-27112 California Univ., Los Angeles. Dept. of Meteorology.
A STUDY OF CANTON ISLAND WINDS
Jacob Bjerknes *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 297-301 (For availability see N74-27092 16-20)
(Grant NSF GA-14354)

For the 6-year period 1962-67 monthly averaged zonal and meridional wind components above Canton Island are presented. The data are for 22 levels between sea surface and 100mb. They show for the months July-September the classical Hadley circulation. However, 9 months of the year, October-June, westerlies above easterlies prevail. This is typical for the Walker circulation which connects the cool descending air in the east with the warm and moist ascending air in the systems of convergence over the western tropical Pacific and Indonesia. The ocean-atmosphere interaction at Canton during 1962 - 67 is illustrated by a comparison between surface wind drag, wind speed, and sea temperature. Author (ESRO)

N74-27113 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
RADAR INDEX AND SHOWERS IN THE TROPICS: A COMPARISON BETWEEN CONTINENT AND OCEAN
Lothar Breuer, Klaus Fraedrich, Christa Muster, Eberhard Ruprecht, and Eide Scheidtmann *In its* Climatolog. Res. Nov. 1973 p 303-311 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

The continental-oceanic differences in shower activity are shown by the mean radar index at several tropical stations. A simple model of the energy budget of showers did not show significant differences between land and ocean. The relative cloud coverage, the ratio of rainfall and effective condensation, and other parameters are computed using this model and two representative radiosonde ascents. Author (ESRO)

N74-27114 Rosenstiel School of Marine and Atmospheric Sciences, Coral Gables, Fla. Div. of Atmospheric Science.
ON THE STRUCTURE OF TROPICAL WEATHER SYSTEM
Mariano A. Estoque and Jose F. Fernandez-Partagas *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 313-331 refs (For availability see N74-27092 16-20)
(Grant NSF GA-10201)

The three-dimensional structure of a weak tropical disturbance east of the Lesser Antilles is studied by using frequent radiosonde releases from the Bomex ship array. By means of composite analysis, the fields of motion, temperature, and moisture were obtained at seven levels, ranging from 1000 to 400 mb. In the composite analysis, it was assumed that the disturbance moved westward at a constant speed without changes in shape or intensity during a twenty-four hour period. The distributions of divergence, vorticity, and vertical motion were derived from the motion field. The analysis shows upward motions in the vicinity of the trough-line and downward motions farther to the east. It also shows relatively cold air primarily at middle levels behind the trough. Cooling in the vicinity of the trough is due to rain evaporation and force convection associated with middle tropospheric convergence. Farther to the east, cooling is due to radiation at the top of the dust layer which follows the region of active convection. Author (ESRO)

N74-27115 National Oceanic and Atmospheric Administration, Las Vegas, Nev. National Hurricane Research Lab.
HURRICANE MODIFICATION RESEARCH
R. Cecil Gentry *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 333-352 refs (For availability see N74-27092 16-20)

Hurricane modification research is conducted in the United States by Project Stormfury, a joint effort of the Department of Commerce and Defense. Modification experiments were conducted on hurricanes in 1961, 1963, and 1969. Results from these experiments were very interesting and especially those in 1969 (Hurricane Debbie) were highly suggestive that the storm was affected by the seeding experiment. Maximum wind speeds decreased 31 and 15 percent respectively following the seedings on the two experimental days. Progress has been great in the supportive research for the project. Theoretical-numerical models were developed which have been used to simulate the life history of a tropical cyclone and many features of the modification experiments. Results from the latter and results from the field experiments have indicated improvements for the design of the modification experiments and have provided information needed for updating the modification hypothesis. These research and experimental results coupled with the modification hypothesis have made it possible to identify the data which are needed to evaluate future modification experiments. Summaries are presented of some of the questions still urgently needing answers and of the future plans of Project Stormfury. Author (ESRO)

N74-27116 Wisconsin Univ., Madison. Dept. of Meteorology.
THE TROPOSPHERIC WIND REGIME OVER ANGOLA [ZUR KENNTNIS DER WINDVERHAELTNISSE UEBER ANGOLA]
Stefan Hastenrath *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 353-360 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

The tropospheric wind regime over Angola (period 1956 - 1961) is analyzed by means of vertical time sections and streamline charts for the levels surface and 3,000 m. Easterlies prevail in the middle and upper troposphere throughout most of the year, whereas the lower-layer circulation over northern Angola is characterized by persistent westerlies, especially during the Southern Hemisphere summer. These are causally related to the development of a lower-tropospheric heat low over southern-hemispheric Africa. Author (ESRO)

N74-27117 Freiburg Univ. (West Germany). Inst. fuer Meteorologie.
ATMOSPHERIC CIRCULATION ANOMALIES AND LEVEL SURFACE FLUCTUATIONS OF LAKE TITICACA
A. Kessler *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 361-372 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

For the period 1958 - 1967 the level fluctuations of Lake Titicaca are investigated in connection with circulation anomalies. A narrow relationship was found between the zonal wind in 500 mb above Antofagasta and the march of the lake level. It is hoped that the relationships found can be evaluated prognostically in the future provided more observational data are available. Author (ESRO)

N74-27118 Tahal Consulting Engineers, Ltd., Tel Aviv (Israel).
THE CLIMATE OF A HIGH VALLEY IN THE ANDES OF COLOMBIA
Naftali Rosenan *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 373-380 refs (For availability see N74-27092 16-20)

The climate of a high elevation valley area in the equatorial Andes of South America is described. The constancy and the height of mean daily temperatures and their wide diurnal range is due to equatorial conditions and elevation. The rainfall regime in its annual run is the main factor influencing conditions of humidity, cloudiness, radiation and evaporation. The climate of the area is almost free from external influences, and therefore it is thought to be suitable for a relatively simple numerical model. Finally, owing to the peculiar properties of the climate of the Boyaca area, studies of comparative climatography are proposed. Author (ESRO)

N74-27119 Deutscher Wetterdienst, Hamburg (West Germany). Seewetteramt.
TIDAL INFLUENCES IN THE SEASONAL TURNS OF THE WIND ALOFT AT DAKAR
Willy Rudloff *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 381-385 refs (For availability see N74-27092 16-20)

The seasonal turns of the wind aloft at Dakar happen about October 2 and June 6 at the beginning and the end of the winterly westwinds preferably 2 days after new or full moon. It is suggested that the wind conditions which rule already in the stratosphere preferably turn over to the troposphere when the tidal forces are at its maximum. Author (ESRO)

N74-27120 Heidelberg Univ. (West Germany). South Asia Inst.
LOCAL WIND PHENOMENA IN THE CENTRAL HIGHLANDS OF CEYLON
U. Schweinfurth and M. Domroes (Tech. Hochschule Aachen) *In* Bonn Univ. Climatol. Res. Nov. 1973 p 387-401 refs (For availability see N74-27092 16-20)

Interest in local wind phenomena in the Central Highlands of Ceylon began with the first observations by U. Schweinfurth in 1959. The Central Highlands of Ceylon act as a climatic divide between SW- and NE-monsoon; while the SW-monsoon drenches the SW of the island with high rainfall, it dries out the eastern part of the Central Highlands as a foehn-like wind and its impact on the tea estates as well as on the peasant agriculture has been studied locally; H. Marby also traced for the first time systematically the local parallel - the foehn-like local wind resulting from the NE-monsoon affecting the Dimbula District; in the 'top-country' of the island of Ceylon the SW-monsoon leads to what one may call monsoon fallow. The intensive way in which the Central Highlands of Ceylon are used in cultivating tea or - locally - in peasant agriculture enables one today, by means of local observations of the climaecological phenomena, to gain a much more detailed idea about the impact of wind in the Central Highlands of Ceylon; this knowledge may have its importance beyond the island of Ceylon as an example of climatological conditions in a tropical mountain country.
Author (ESRO)

N74-27121 Bonn Univ. (West Germany).
THE TRACKS OF ANTICYCLONES AND CYCLONES AS A PROBLEM OF SYNOPTIC CLIMATOLOGY AND CLIMATO-GEOGRAPHY
Joachim Bluethgen *In its* Climatolog. Res. Nov. 1973 p 403-416 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

Climate may be defined as a characteristic sequence of different weather types caused by moving cyclones or anticyclones which are following special trajectories. Thus these trajectories are of climatic relevance, nevertheless they have been discussed only quite scarcely. Investigation of the tracks of barometric units started as early as weather maps were introduced to modern meteorology. The study of the tracks of barometric units is of great importance for synoptic interpretation of climatic means under climatological aspects. Some examples are discussed. To get a more differentiated picture of the great geographical variability of the individual tracks it is obviously necessary to combine the trajectories occurring in the course of the year with a more detailed classification of anticyclones and cyclones. Thus the dynamics of the climate can be revealed synoptically in addition to what has already been done by studying weather types, fronts, air transports, and air masses. Author (ESRO)

N74-27122 Innsbruck Univ. (Austria). Inst. fuer Geographie und Alpengeographie.
THE ALPS AS CLIMATIC BOUNDARY: CONCEPTION AND REALITY
Franz Fliri *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 417-426 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

According to the common opinion the Alps or their main range (Alpenhauptkamm) bear a well developed continental climatic boundary especially between the main continent and the Mediterranean. But neither a profile across the Alps from north to south in Tyrol nor the areas of the seasonal distribution of the precipitation prove a such simplified assumption. On the contrary the Alps are more a wide field of transition from west to east. The changing of climate from the north to the south is very complex in relation to the relief as is demonstrated as well as by predominating autumn rainfall in the north of the main range as by summer rainfall maxima near to the southern border of the Alps. Author (ESRO)

N74-27123 Freiburg Univ. (West Germany). Inst. fuer Geographie.
INVESTIGATIONS ON THE CIRCUMGLOBAL RADIATION IN HOECHENSCHWAND (SOUTHERN BLACK FOREST, WEST GERMANY)
Dieter Havlik *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 427-434 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

For the period 1960-1970 annual course and frequency distribution of the circumglobal radiation, as measured with the spherical pyranometer Bellani were analyzed for the station of Hochenschwand. It seemed useful to introduce a new parameter, the average intensity of circumglobal radiation per hour of locally possible insolation (ZI). A survey of how ZI-values depend on large scale weather situations, classified after the Hamburg Scheme, is added. Author (ESRO)

N74-27124 Wien Univ. (Austria).
WINTER PRECIPITATION IN VIENNA: WEATHER SITUATIONS, CHRONICLE, FORECAST
Friedrich Lauscher *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 435-441 In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

A statistic evaluation of daily precipitation in Vienna for the 25 years 1946 - 1970 and for 16 different synoptic situations, as well as a chronicle of the 15 most interesting single cases is presented as a basis for a synoptic study of these situations. It turns out in particular that the detailed characteristics of Vb-situations have to be considered attentively by the forecaster. Additionally it becomes evident that the soaking of north-east-European cold air masses via the Mahrische Pforte into the Veinna basin bears some significance. Author (ESRO)

N74-27125 Mainz Univ. (West Germany). Inst. fuer Meteorologie.
THE RELATION BETWEEN ATMOSPHERIC PRESSURE AND PRECIPITATION
W.-G. Panhans and D. Schreiber *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 443-448 In GERMAN; ENGLISH summary

(For availability see N74-27092 16-20)

The relation between atmospheric pressure and precipitation was tested. At one station all cases of precipitation were compared with the pressure during 42 months. Most cases of precipitation were found to be connected with high and rising pressure. The reasons of the phenomenon are short showers after cold fronts and cold anticyclones. Longtime precipitations happen during low and falling pressure. So precipitation is more probable during low atmospheric pressure than during high pressure.

Author (ESRO)

N74-27126 Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Inst. fuer Atmosphaerische Umweltforschung.

STUDIES CONCERNING THE PROBLEM OF CONDITIONS AND MANNER OF TRANSPORTATION OF STRATOSPHERIC AIR PACKAGES REACHING THE EARTH'S SURFACE IN THE MIDDLE LATITUDES

E. Reinhold Reiter *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 449-466 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

(Contract AT(30-1)-4061)

Membrane filters were exposed to a total of 2000 cubic meters of air during 24 hours each day at the Zugspitze peak station. The radio nuclides P32 and Be7 produced by cosmic rays in the stratosphere, plus the heavy metals of the fallout, are each separately extracted from the filter mass by quantitative chemical methods. Concentration in the air, of the above mentioned elements is then determined by these chemical samples by means of gamma and beta ray spectrometry. The daily fluctuations in concentration of the radionuclide covered are closely related to meteorological conditions in the lower stratosphere in the tropopause layer and in the troposphere. Detailed theoretical analyses of our data permit determination of the stratospheric-tropospheric exchange processes involved as well as the modes of transportation of the air packages covered. This procedure is based upon computation of isentropic trajectories and potential vorticity. To this end, the radiosonde data from the Atlantic Ocean and from Europe are used. The entire, complex procedure involving sampling, chemical and physical processes, mathematical and meteorological evaluations, is demonstrated by an example.

Author (ESRO)

N74-27127 Genoa Univ. (Italy). Ist. Geofisico e Geodetico.

ON SEA AND LAND CLIMATE DIFFERENCES

Mario Bossolasco, Ignazio Dagnino, and Giuseppe Flocchini *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 467-473 refs (For availability see N74-27092 16-20)

Some simple quantitative approaches are presented and discussed in order to represent the degree of maritimity of some Thyrrenian coastal stations, as well as the continentality of a few Po Valley stations. The thermoregulation effect of the Mediterranean Sea on the neighboring land areas exhibits a behavior different from other regions. New data and approaches are presented to contribute to a better understanding of the sea and land climate differences.

Author (ESRO)

N74-27128 Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

THE URBAN AREA AS TARGET FOR METEOROLOGICAL RESEARCH

H. E. Landsberg *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 475-480 refs (For availability see N74-27092 16-20)

(Contract NSF GA-13533)

It is pointed out that weather predictions made by present procedures and with network observations are inadequate for the needs of urban populations. The effects of surface changes brought about by urbanization on heat balance and wind field feed back into synoptic pattern on a meso-scale. They affect pollution concentration, cloudiness, and precipitation. The primary causes are increased roughness and the urban heat island. Their effects become dominant when the general flow patterns are weak. Individual local models for forecasting are needed.

Author (ESRO)

N74-27129 Hebrew Univ., Jerusalem (Israel). Dept. of Atmospheric Sciences.

EVOLUTION OF A SEA BREEZE FRONT: A NUMERICAL STUDY

J. Neumann and Y. Mahrer *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 481-492 refs (For availability see N74-27092 16-20)

The results of detailed analysis of the sea-and-land-breeze circulation for the period between 1200 and 1600 hrs when the sea breeze circulation is at its maximum intensity are discussed. Late in the morning a (warm) low forms about the surface position of the sea-breeze front. As the front penetrates inland this low deepens and a strong horizontal convergence of the winds develops near the surface about the front. But the probably new and surprising features are the developments aloft (between about 1 and 2 km): strong horizontal divergence in advance of the front, a dome of warm air and (relatively) high pressure above the surface position of the front. The vertical velocities exhibit a cell of upward motion in advance and one of downward motion in the rear of the front.

Author (ESRO)

N74-27130 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.

ON THE CLIMATOLOGY AND MECHANISMS OF COLORADO CHINOOK WINDS

Herbert Riehl *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 493-504 refs (For availability see N74-27092 16-20)

About 100 chinook situations occur within ten years in the foothills of northern Colorado. Of these, one-third affect the growing season. At Fort Collins, the highest gust measured during 1964 - 1971 was 87 mph. Peak speeds in the range from 40 to 60 mph were common; the ratio of peak gust to 5-minute mean wind averaged near 1.55. Duration of chinook episodes ranged from less than two to over 16 hours. Most events took place during eastward passage of upper troughs ahead of the attendant cold fronts. The large-scale zonal acceleration field gives the right order of magnitude, but local concentration of the pressure change field in the foothills area and downward momentum transport from upper levels must also be included. Specific humidity nearly always increases along the downward chinook trajectories. The desiccating effect of an average chinook event is estimated at about 0.8 cm equivalent moisture depth on the lee slopes during winter. Given an average frequency of events, the total desiccation during the colder season amounts to 20 - 25 percent of precipitation, a large fraction, offset however by the fact that this drying out occurs during the dormant vegetative period. A large impact may be expected from the rarer cases during the growing season; the existence of summer chinook episodes is an important factor for the climate of the region.

Author (ESRO)

N74-27131 Schweizerische Meteorologishe Zentralanstalt, Glattbrugg.

A CLIMATOLOGICAL STUDY OF FOG FREQUENCY

M. Schueepp *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 505-511 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

According to the experience in the field of climatological processing of the fog frequency and referring to the recommendation of the World Meteorological Organization (1. Session of the Commission of Climatology, Washington 1953) it is suggested to use the percentage fog frequency instead of the number of days with fog. A map of Switzerland for example reproduces and comments upon this fact.

Author (ESRO)

N74-27132 Academy of Science of the Georgian SSR, Tbilisi (USSR). Inst. of Geography.

DYNAMICS OF THE GAS COMPOSITION OF THE EARTH'S ATMOSPHERE

F. F. Davitaya *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 513-522 refs (For availability see N74-27092 16-20)

The gas composition of the earth's atmosphere was not invariable during the geologic calage. Values of the organic production of atmospheric oxygen are presented for the geologic epochs back to 500 million years. According to these and other estimates the density and composition of the atmosphere changed considerably until a dynamic equilibrium was reached, probably in the Triassic period. For at least 200 million years the total amount of free atmosphere oxygen was stationary. The anthropogenic increase in atmospheric carbon dioxide content, however, must irrecoverably change the oxygen concentration. Estimates

for the expenditure of O2 and production of CO2 due to combustion are presented and discussed. Author (ESRO)

N74-27133 Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.

THE STRUCTURE OF THE WIND PROFILE FROM SURFACE TO 25 km IN VARIOUS CLIMATIC ZONES

Oskar M. Essenwanger *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 523-539 refs (For availability see N74-27092 16-20)

The vertical structure of the wind profile from the surface to 25 km was examined based on a mathematical description of the speed and direction profile. The system leads to five different wind profile groups or 14 subgroups, which appear invariant to individual model division. The number of individual models depends on the desired tolerance for the average deviation of the observed wind profile from the best suited prototype. The profile groups differ largely with respect to altitude, symmetry, and the number of maxima. About 85% of the profiles in midlatitude and subtropics exhibit a single wave pattern with maximum in the troposphere, while this class drops to 65 and 40% in the polar and tropical zone, respectively. It is replaced by a type whose maximum is located in the stratosphere above 20 km, with 40% and 25% frequency in the Tropics and polar region, respectively, and minor importance in the other zones. The remainder shows a double wave with maxima in the troposphere and stratosphere, usually above 20 km. The derived groups display a typical structure of the wind profile in four climatic regions. Special features investigated are the relationship between speed and direction profile, wind maximum and average wind speed, and vertical vector shear. While the altitude of the wind speed maximum in general is independent of the average wind speed (surface to 25 km), a significant correlation can be discovered in the tropical and subtropical zone during the summer months. Author (ESRO)

N74-27134 Texas A&M Univ., College Station. Dept. of Meteorology.

STATISTICAL ASPECTS IN APPLIED CLIMATOLOGY

John F. Griffiths *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 541-548 refs (For availability see N74-27092 16-20)

In terms of some illustrative examples it is shown that applied climatology is fraught with problems, especially in the statistical aspect. Even the use of simple statistics can turn out to be less simple than was thought originally. It is only by careful selection of methods and awareness of the mathematical limitations that an experiment can be well designed, accomplished and analyzed. Author (ESRO)

N74-27135 East Anglia Univ., Norwich (England). School of Environmental Sciences.

CONTRIBUTIONS TO HISTORICAL CLIMATOLOGY: THE MIDDLE AGES AND AFTER; CHRISTMAS WEATHER AND OTHER ASPECTS

H. H. Lamb *In* Bonn Univ. Climatolog. Res. Nov. 1973 P 549-567 refs (For availability see N74-27092 16-20)

The types of manuscript information available on European weather over some centuries before the invention of the barometer and thermomter are briefly reviewed and it is shown how the rich amount of data available may be submitted to meteorological analysis. Numerical indices of the prevailing character of the winters and summers over periods of ten years (or longer) are defined for this purpose. Analysis of the values of these indices, and their sequence through the middle ages and since, in different longitudes in Europe is seen to verify the general trustworthiness of the original manuscript information and points to changes in the prevailing values of temperature and rainfall over England. Records are presented of Christmas weather in the London area,which are complete since the year 1660. The result supports indications already reported in the German meteorological literature that the character of the atmospheric circulation prevailing over the four pentads centered about New Year is a sensitive indicator of tendencies at any given time affecting atmospheric circulation and climate over the whole year. Author (ESRO)

N74-27136 Tubingen Univ. (West Germany). Inst. fuer Astronomie.

THE CONCENTRATION OF ATMOSPHERIC SMALL IONS OVER THE ATLANTIC OCEAN AS AN INDICATION FOR GLOBAL AIR POLLUTION

Richard Muehleisen *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 569-573 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

The concentration of atmospheric small ions is balanced by ionization and ion disappearance. Because the ionization over the ocean is temporally constant, the concentration of ions and thus the air conductivity depends mainly on the processes of attachment onto aerosol particles. On the Atlantic Ocean the ion concentration was approximately 600 ion pairs/cubic centimeter around 1920. According to measurements in 1965 and 1969 the concentration has meanwhile decreased to only about 250 ion pairs/cubic centimeter. This can only be explained by a factor 3 increase of air pollution over the Atlantic Ocean. Author (ESRO)

N74-27137 Cologne Univ. (West Germany). Inst. fuer Geologie.

VOLCANOES CONSIDERED BY A PALAEOCLIMATOLOGIST

Martin Schwarzbach *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 575-596 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

The influence of volcanoes on the climate has been investigated. Volcanoes influence the local climates: conspicuous windward and leeward sides in the trade-wind girdle, high volcanoes may have glaciers even near the equator (a possibility which explains certain tillites!), porous lavas favour the development of edaphically caused deserts. - In the opionion of some palaeoclimatologists, volcanoes influence essentially the whole climate of the earth (by CO2 and ash dust in the atmosphere), but this is considered to be a very small factor, likewise the influence of volcanic dust on the albedo of ice. Author (ESRO)

N74-27138 Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).

METHODICAL REMARKS ON THE EVALUATION OF WIND ROSES

Ferdinand Steinhauser *In* Bonn Univ. Climatolog. Res. Nov. 1973 p 597-600 refs In GERMAN; ENGLISH summary (For availability see N74-27092 16-20)

Map representations of the eight main wind directions are described. The unreliability of the wind-rose method of presentation is discussed. A method is proposed for the partitioning of the frequencies of the secondary directions in proportion to the frequencies of the adjacent main directions. Examples of the process for presenting wind directiop information are provided. Author (ESRO)

N74-27139# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

OPTICAL REMOTE SENSING FOR AEROLOGY. MEASUREMENTS OF WATER VAPOR DISTRIBUTION OF THE ATMOSPHERE USING LIDAR ABSORPTION METHOD

Christian Werner and Hartmut Herrmann Sep. 1973 37 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-110) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 12,70 DM

The DFVLR-Lidar-System 3 was used during 1972 to measure water vapor distribution in the atmosphere. Results show the possibility of determining water vapor density by this differential absorption method. A new system planned for field measurements is shown. Author (ESRO)

N74-27140# Royal Netherlands Meteorological Inst., De Bilt.

COMPASS WIND DISTRIBUTION FOR HIGH VELOCITIES [WINDROZEN VOOR HOGE SNELHEDEN]

T. B. Ridder 1972 14 p ref In DUTCH

(V-242) Avail: NTIS $4.00

Wind velocity distributions over the directions of a compass were investigated for several places in the Netherlands over the period 1931-1960, and for three criteria: (1) not taking into account wind velocity and (2) taking into account wind velocity over 15 m/s, and (3) over 20 m/s. It is shown that a distribution not taking account of velocity does not apply to higher velocities.

For higher velocities the distribution depends on the geographic situation and local circumstances. ESRO

N74-27141# Royal Netherlands Meteorological Inst., De Bilt.
COMPARISON OF FREQUENCY DISTRIBUTIONS OF HOURLY WIND VELOCITY AVERAGES WITH CORRESPONDING DISTRIBUTIONS BASED ON 10 MINUTE AVERAGES [VERGELIJKING VAN FREQUENTIEVERDELINGEN VAN UURGEMIDDELDEN VAN DE WINDSNELHEID MET DE OVEREENKOMSTIGE VERDELINGEN GEBASEERD OP 10-MINUTENGEMIDDELDEN]
P. J. Rijkoort 1972 21 p In DUTCH
(V-243) Avail: NTIS HC $4.25

A comparison was made of frequency distributions of corresponding hourly and 10 minute wind velocity averages, and some samples were taken to determine the statistical difference between these averages. In climatology, wind velocity and wind direction are not determined over the same interval, but velocity over an hour, and direction over a 10 minute interval, the middle of which corresponds to the beginning of an hour. The consequences of a transition from an hourly to a 10 minute velocity average on the homogeneity of a series of climatological wind measurements were studied. ESRO

N74-27142# Royal Netherlands Meteorological Inst., De Bilt.
THE PLUME OF A LARGE COOLING TOWER, PART 2 [DE PLUIM VAN EEN GROTE KOELTOREN, II]
H. A. R. Wessels and J. A. Wisse 1971 14 p refs In DUTCH; ENGLISH summary
(WR-72-03) Avail: NTIS HC $4.00

The plume length, and the possibility of a wet cooling tower plume causing fog and/or precipitation are discussed. Calculations are based on a model and a nomogram to estimate the length of the plume. It is assumed that the enthalpy of air passing through the tower is increased by 45 kJ/kg, and that the tower has an upper diameter of 60 m. The nomogram was applied to data from radio soundings at De Bilt, the Netherlands, at 0000 and 1200 CET and at Goch, Federal Republic of Germany, 0600 CET. ESRO

N74-27143# Royal Netherlands Meteorological Inst., De Bilt.
AN AIR POLLUTION MODEL OF ZEELAND
S. L. Sarin 1972 13 p refs
(WR-72-5) Avail: NTIS HC $4.00

The consequences of a changing sulphur dioxide source pattern in Zeeland (Netherlands) were studied with the aid of an air pollution model. The seasonal averages of concentrations were calculated by using the diffusion climatology from a meteorological station. Pollutant concentration patterns for three different cases are given only for winter. The physical chimney heights of the planned sources were varied in order to assess changes in the ground level concentrations. ESRO

N74-27144# Royal Netherlands Meteorological Inst., De Bilt.
MEASUREMENTS OF RAINDROPS AT DE BILT, THE NETHERLANDS [METINGEN VAN REGENDRUPPELS TE DE BILT]
H. R. A. Wessels 1972 47 p refs In DUTCH; ENGLISH summary
(WR-72-6) Avail: NTIS HC $5.50

Raindrop size distributions, measured with a filter paper technique, were analyzed with the Best formula. The measurements were carried out for several types of rains. From the spectra, the relationship between radar echo intensity and precipitation intensity was calculated. The drop spectra parameters relate systematically to rain intensity and not to other meteorological parameters. ESRO

N74-27145# Royal Netherlands Meteorological Inst., De Bilt.
EXPERIMENTS IN NUMERICAL PRODUCTION OF PRECIPITATION FORECASTS [EXPERIMENTEN MET HET NUMERIEK OPSTELLEN VAN NEERSLAGVERWACHTINGEN]
A. W. DenEcterBlokland 1972 71 p refs In DUTCH; ENGLISH summary
(WR-72-8) Avail: NTIS HC $6.75

Results of some numerical precipitation forecasts are presented. Computations were made within the frame of a three level baroclinic model, which is at present run operationally twice a day. The precipitation forecast itself is still in an experimental phase; further development must be awaited before the results can be considered suitable for forecasting purposes. The computational scheme is only suitable for forecasting large scale precipitation. Experimental results are presented in the form of line printer charts with instantaneous precipitation and as sets of values of accumulated amounts in grid points. ESRO

N74-27146# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11607 LANCE MISSILE NO. 2161, ROUND NO. 203 RCT (19 OCTOBER 1973) Meteorological Data Report
Oct. 1973 24 p
(DA Proj. 1T6-65702-D-127)
(AD-776901; DR-798) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11607 Lance, Missile Number 2161, Round Number 203 RCT, are presented in tabular form. Author (GRA)

N74-27147# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 16101 LITTLE JOHN MISSILE NO. 3113, ROUND NO. 703 RO (16 NOVEMBER 1973) Meteorological Data Report
Nov. 1973 18 p
(DA Proj. 1T6-65702-D-127)
(AD-776906; DR-804) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 16101 Little John, Missile Number 3113, Round Number 703 RO, are presented in tabular form. Author (GRA)

N74-27148# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14102 RIP MISSILE NO. 10242, ROUND NO. 12 (14 NOVEMBER 1973) Meteorological Data Report
Nov. 1973 18 p
(DA Proj. 1T6-65702-D-127)
(AD-776905; DR-803) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14102 RIP, Missile Number 10242, Round Number 12, are presented in tabular form. Author (GRA)

N74-27149# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 16101 LITTLE JOHN, MISSILE NOS. 3131/3117, ROUND NOS. 701 RO/702 RO (13 NOVEMBER 1973) Meteorological Data Report
Nov. 1973 33 p
(DA Proj. 1T6-65702-D-127)
(AD-776904; DR-802) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 16101 Little John, Missile Numbers 3131/3117, Round Numbers 701 RO/702 RO, are presented in tabular form. Author (GRA)

N74-27150# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 14102 RIP MISSILE NO. 10256, ROUND NO. 3 Meteorological Data Report
2 Nov. 1973 24 p
(DA Proj. 1T6-65702-D-127)
(AD-776924; DR-808) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 14102 RIP, Missile Number 10256, Round Number 3, are presented in tabular form. Author (GRA)

N74-27151# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11602 LANCE MISSILE NO. 2118, ROUND NO. 211 RST Meteorological Data Report
Feb. 1974 43 p
(DA Proj. 1T6-65702-D-127)
(AD-776923; DR-819) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11602 Lance, Missile Number 2118, Round Number 211 RST, are presented in tabular form. Author (GRA)

N74-27152# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 03702 HONEST JOHN MISSILE NO. 1774, ROUND NO. 637 AML (9 NOVEMBER 1973) Meteorological Data Report
Nov. 1973 24 p
(DA Proj. 1T6-65702-D-127)
(AD-776903; DR-801) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 03702 Honest John, Missile Number 1774, Round Number 637 AML, are presented in tabular form. Author (GRA)

N74-27153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF WORK IN COMBATING HAIL DAMAGE
I. T. Bartishvili, I. V. Benito, I. I. Burtsev, I. I. Gaivoronoskii, A. D. Dzhuraev, A. I. Kartsivadze, and Yu. A. Seregin 25 Feb. 1974 24 p refs Transl. into ENGLISH from Tr. v Vses. Meteorol. Sezda. Sekt. Aktivnykh Vozdeistvii na Atm. Protsessy (USSR), v. 4, 1972 p 23-36
(AD-776733; FTD-MT-24-213-74) Avail: NTIS CSCL 04/2

Contents: Results of antihail operations using the artillery method in the Northern Caucasus (KPEVGI); Results of antihail operations carried out by the rocket method in the Georgian SSR (SBG, IGAN); Results of antihail operations by the ZakNIGMI method. GRA

N74-27154# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A THREE-PARAMETER MODEL FOR LIMITED AREA FORECASTING
L. Bengtsson Mar. 1974 124 p refs
(AD-777406; ENVPREDRSHCHFAC-TP-5-74) Avail: NTIS CSCL 04/2

The report describes an operational quasi-geostrophic three-parameter model. The original model was developed by Dr. L. Bengtsson and has been used operationally for several years at the Swedish Meteorological and Hydrological Institute. The improved model described in this report incorporates an Ekman function and the effect of the flow over mountains as well as sensible and latent heat sources. Humidity and precipitation are also predicted by the model. (Modified author abstract) GRA

N74-27155# Ocean-Atmosphere Research Inst., Cambridge, Mass.
COHERENT DELINEATION OF CLIMATIC CHANGES OVER THE NORTH PACIFIC OCEAN: ICE IN THE SOUTHERN OKHOTSK SEA Semiannual Technical Report, 1 Jul. - 31 Dec. 1973
Irving I. Schell and E. N. Sabbagh Feb. 1974 15 p refs
(Contract F44620-72-C-0040)
(AD-776080; AFOSR-74-0360TR) Avail: NTIS CSCL 08/10

An analysis was made of the decadal ice conditions in the Southern Okhotsk Sea as observed along the coast of northern Hokkaido, in relation to the strength of the northeasterly winds over the Kamchatka Penninsula, the Okhotsk Sea, and adjacent areas the last 50 years 1921-1970. The results were then compared to the ice conditions off Iceland (Greenland Sea) and also the frequency of icebergs off Newfoundland. It is found that the severity of the ice conditions in the southern Okhotsk Sea are related to the strength of the northeasterly winds in winter, the decade with the lightest ice conditions (1931-40) being associated with weaker northeasterlies, and the decade with the heaviest ice conditions (1941-50) with stronger northeasterlies than in the other decades of the period. (Modified author abstract) GRA

N74-27156# National Climatic Center, Asheville, N.C.
US NAVAL WEATHER SERVICE COMMAND SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. WESTERN EUROPEAN COASTAL MARINE AREAS. VOLUME 7: AREA 37 - GULF OF FINLAND, AREA 38 - GULF OF BOTHNIA S, AREA 39 - GULF OF BOTHNIA N, AREA 40 - MURMANSK, AREA 41 - ANDENES, AREA 42 - CENTRAL NORWEGIAN COAST, AREA 43 - OSV MIKE
Jan. 1974 512 p Sponsored in part by Naval Service Command, Washington, D.C.
(AD-777133) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. GRA

N74-27157# Army Electronics Command, Fort Monmouth, N.J.
AN ANALYSIS OF LORAN AND WIND-MEASURING ACCURACIES FOR APPLICATION TO FIELD ARMY USE Research and Development Technical Report
William C. Barr Apr. 1974 47 p refs
(DA Proj. 1T0-62111-A-126)
(AD-777500; ECOM-5536) Avail: NTIS CSCL 04/2

The basic principles and equations of radionavigation systems have been applied to estimate the wind-measuring accuracy of the Loran-C and Loran-D systems. For Loran-C, the equations for the time difference gradients on the spherical earth have been derived, and a simple method of correcting them to give approximate gradients on a spheroidal earth has been given. For Loran-D, the time difference gradients have been calculated using a flat earth approximation. (Modified author abstract) GRA

N74-27158# Meta Systems, Inc., Santa Clara, Calif.
THE ACQUISITION AND USE OF METEOROLOGICAL DATA IN AN AUTOMATED OCEANIC AIR TRAFFIC CONTROL SYSTEM Final Report, Mar. 1972 - May 1973
Frank V. Giallanza, Charles P. Giallanza, and James C. Brown Dec. 1973 56 p refs
(Contract DOT-FA72WA-2851)
(AD-777269; FAA-RD-73-142) Avail: NTIS CSCL 04/2

The sources from which meteorological data can be acquired and how the data can be used in an automated oceanic air traffic control system are discussed. A proposed data base for meteorological data is defined. Interpolation and extrapolation methods, and a process by which the data base can be updated are described. Author (GRA)

N74-27159# Weather Squadron (12th), Ent AFB, Colo.
COMPUTER MAP TYPING - OPTIMIZING THE CORRELATION COEFFICIENT THRESHOLD
Robert C. Sabin Jan. 1974 34 p refs
(AD-777600; Rept-12WS-TP-74-2) Avail: NTIS CSCL 04/2

The 12th Weather Squadron has been developing procedures for the incorporation of computer derived weather map analog information into a terminal forecast system. Prior to the routine development of synoptic map type catalogs for the CONUS, it was necessary to answer several questions relative to the procedures which would be employed in the preparation of each catalog. This paper addresses only one of these questions: What correlation coefficient threshold provides the best of map types. The choice of an appropriate threshold value is, at best, a compromise. This paper shows that a value of 0.8 produces a typing system with a reasonable degree of similarity within each type, a good overall description of the pressure patterns affecting the area, an acceptable number of uncorrelated maps, and an adequate description of the climatology within each type. Author (GRA)

N74-27160# RAND Corp., Santa Monica, Calif.
THE RADIATION AND HEAT BUDGET OF THE MINTZ-ARKAWA MODEL, JANUARY
Anne B. Kahle and Frank Haurwitz Oct. 1973 71 p refs
(Contract DAHC15-73-C-0181)
(AD-777077; R-1318-ARPA) Avail: NTIS CSCL 04/2

The report describes the results of a detailed examination of the radiation and heat budgets of the Rand version of the Mintz-Arakawa two-level atmospheric general circulation model for a January control run. The Mintz-Arakawa model is used extensively in the Rand Climate Dynamics Project, for the Defense Advanced Research Projects Agency, and this study represents part of the continuing effort to verify and improve the model. Considerations of the sort undertaken here are necessary to insure that the radiation and heat terms in the model are good approximations to the real atmosphere, and that one may reasonably perform numerical experiments with the model. GRA

N74-27161# Denver Research Inst., Colo.
THE ENGINEERING, MICROPHYSICAL, AND DYNAMICAL ASPECTS OF PRECIPITATION MANAGEMENT Final Report, Jul. 1970 - Jun. 1973
N. Fukuta, M. N. Plooster, Y. Paik, L. F. Evans, and A. Gorove Aug. 1973 155 p refs
(Contract DI-14-06-D-7048)
(PB-227783/8; DRI-2628) Avail: NTIS HC $10.75 CSCL 04B

Results of studies on two subjects, development of an orographic cloud seeding model and of organic ice nuclei generators comprise the main part of this report. An orographic cloud seeding model, considering the air flow above a model mountain, the concentration, temperature spectrum and eddy diffusion of artificial ice nuclei, and the microphysics of ice crystals formation and growth was developed. A new method of using a supersonic nozzle was developed for generating smoke particles of organic ice nuclei compounds, making use of water as the carrier gas. Further studies were made to develop methods for continuous handling of seeding materials and design of the superheated steam generator. General problems of organic generator technology were discussed. GRA

N74-27162# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
COMPILATION OF AIR POLLUTANT EMISSION FACTORS, SUPPLEMENT 1, SECOND EDITION
Jul. 1973 29 p
(PB-228708/4) Avail: NTIS HC $4.50 CSCL 13B

Data are revised on atmospheric emission concerning the storage, transportation, and marketing of petroleum products. Author

N74-27163# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
LASER CEILOMETERS. RESULTS OF COMPARISON TESTING OF AN ERBIUM AND A RUBY LASER CEILOMETER WITH A STANDARD ROTATING BEAM CEILOMETER Interim Report
Eugene Y. Moroz, Clyde L. Lawrance, and George A. Travers 13 Dec. 1973 20 p refs
(AF Proj. 6670)
(AD-777201; AFCRL-IP-208; AFCRL-TR-73-0751) Avail: NTIS CSCL 04/2

Results of test and evaluation of two laser ceilometers, by AFCRL, are presented and discussed. A test program was initiated in 1970 to evaluate the applicability of lasers to determine cloud height for navigational guidance. The approach was to study the characteristics of laser ceilometers, and to determine how the cloud return data obtained from these systems compare with data generated by the standard Air Force rotating beam ceilometer (RBC). Two laser ceilometers were tested. One was a ruby system manufactured by ASEA of Sweden, and the other was a prototype eye-safe erbium lidar developed by the American Optical Corporation, Framingham, Massachusetts. Data comparisons show that lidars produce the same type of cloud height information as the RBC. The lidars tested have a significantly greater ranging capability than the RBC and provide more cloud structure information. It was concluded that lidars are potentially superior to the standard rotating beam ceilometer as cloud height measuring devices. Author (GRA)

N74-27164# National Climatic Center, Asheville, N.C.
US NAVAL WEATHER SERVICE COMMAND SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS - WESTERN EUROPEAN COASTAL MARINE AREAS. VOLUME 8: AREA 44 - ICELAND SE, AREA 45 - REYKJAVIK, AREA 46 - ICELAND NW, AREA 47 - ICELAND N, AREA 48 - ICELAND NE, AREA 49 - ANGMAGSSALIK, AREA 50 - CAPE FAREWELL SE
Jan. 1974 565 p Sponsored by Naval Weather Service Command
(AD-777601) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data family 11 (TDF 11) marine surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. GRA

N74-27165# Environmental Prediction Research Facility (Navy), Monterey, Calif.
USING HELICOPTERS TO CLEAR FOG: A NUMERICAL STUDY
David B. Johnson, Edward H. Barker, and Paul R. Lowe Mar. 1974 41 p refs
(AD-777429; ENVPREDRSCHF-Tech-Paper-2-74) Avail: NTIS CSCL 04/2

A two-dimensional axial symmetric cloud dynamics model, which uses the Boussinesq approximation form of the equations of motion, was used to study downwash-induced fog clearings. The flow produced by constraining the vorticity to a prescribed value in a small region near the centerline of the model is similar to that observed to occur below a hovering helicopter. Several numerical experiments are discussed which show the efficacy of different hovering altitudes on the clearing of fog. The major feature affecting the size of clearing by helicopter downwash is the size of the primary downwash volume. (Modified author abstract) GRA

N74-27166# Denver Research Inst., Colo.
KINETIC STUDIES OF ICE CRYSTAL GROWTH, VOLUME 2 Final Report
Norihiko Fukuta, Young H. Paik, V. K. Saxena, James Armstrong, and Arpad Gorove Aug. 1973 79 p refs
(Grant NSF GA-29525)
(PB-227808/3; NSF-RA/E-73-011-Vol-2; DRI-2627) Avail: NTIS HC $7.00 CSCL 04B

The following topics are considered:(1) Kinetic threshold conditions for fog formation in cloud chambers and marine environment;(2) A hypothesis of hurricane modification by cloud seeding; and (3) Development and testing of a supercooled cloud tunnel. GRA

N74-27167# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC CONDITIONS OF EMERGENCE AND DEVELOPMENT OF FREE ATMOSPHERIC CONVECTION (CHAPTER 1)
S. M. Shmeter 26 Mar. 1974 40 p Transl. into ENGLISH from the book "Fizika Konvektivnykh Oblakov" USSR, 1972 p 6-31
(FTD Proj. T74-01-19)
(AD-777681; FTD-MT-24-435-74) Avail: NTIS CSCL 04/2

Variations of an adiabatic method are presented to obtain the vertical stability of the atmosphere based on its relation to free irregular convection. The nonadiabaticity of convection is also considered which takes into account the continuous process of drawing in of the surrounding air inside the rising or descending elements of convection. Cloud forming thermals in the form of bubbles and jets, and entrainment of surrounding air inside thermal is also discussed. A.A.D.

N74-27168# National Weather Service, Silver Spring, Md. Techniques Development Lab.
OBJECTIVE TECHNIQUES FOR FORECASTING THUNDERSTORMS AND SEVERE WEATHER Final Report, Feb. 1971 - Jul. 1973
M. A. Alaka, W. D. Bonner, J. P. Charba, R. L. Crisci, and R. C. Elvander Jul. 1973 103 p refs
(Contract DOT-FA67WAI-131)
(AD-777155; FAA-RD-73-117) Avail: NTIS CSCL 04/2

The report describes research and developmental efforts and achievements made by the Techniques Development Laboratory to generate and disseminate improved objective, computerized forecasts of thunderstorms and severe weather to serve aviation interests. The effort is focused on two main categories of forecasts: Medium range forecasts (6-24 hrs) intended primarily for planning purposes, and short range forecasts (0-6 hrs) necessary for operational decision making. (Modified author abstract) GRA

N74-26883 Joint Publications Research Service, Arlington, Va.
LONG RANGE WEATHER FORECASTING METHODS BASED ON THE SOLUTION OF BASIC AND CONJUGATE

PROBLEMS
G. I. Marchuk *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 18-38 ref Transl. into ENGLISH from Meteorol. Gidrol. (Moscow) no. 3, 1974 p 17-34 (For availability see N74-26880 16-13)

N74-26884 Joint Publications Research Service, Arlington, Va.
ON THE PREDICTION OF SEVERE WEATHER
A. N. Bagrov, V. N. Vapnik, and A. I. Snitkovskiy *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 39-50 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 35-43 (For availability see N74-26880 16-13)

N74-26893 Joint Publications Research Service, Arlington, Va.
CALCULATION OF THE TRANSPORT RATE OF BARIC FORMATIONS THROUGH THE ISALLOBAR FIELD
F. T. Doroshenko *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 123-125 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 100-102 (For availability see N74-26880 16-13)

N74-26897 Joint Publications Research Service, Arlington, Va.
REVIEW AND BIBLIOGRAPHY CONDITIONS OF FORMATION AND FORECASTING OF LOW-ALTITUDE CLOUDS
A. M. Baranov *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 150-153 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 117-118 (For availability see N74-26880 16-13)

N74-26898 Joint Publications Research Service, Arlington, Va.
AN UNUSUAL CYCLONE
S. V. Chelyukanova *In its* Meteorol. and Hydrol., No. 3, 1974 (JPRS-62052) 22 May 1974 p 165-167 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 3, 1974 p 123-124 (For availability see N74-26880 16-13)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-27169*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
A GUIDANCE AND NAVIGATION SYSTEM FOR CONTINUOUS LOW THRUST VEHICLES M.S. Thesis
Charles Jack-Ching Tse Aug. 1973 100 p refs
(Grant NGR-22-009-207)
(NASA-CR-138676; TE-53) Avail: NTIS HC $8.00 CSCL 17G

A midcourse guidance and navigation system for continuous low thrust vehicles is described. A set of orbit elements, known as the equinoctial elements, are selected as the state variables. The uncertainties are modelled statistically by random vector and stochastic processes. The motion of the vehicle and the measurements are described by nonlinear stochastic differential and difference equations respectively. A minimum time nominal trajectory is defined and the equation of motion and the measurement equation are linearized about this nominal trajectory. An exponential cost criterion is constructed and a linear feedback guidance law is derived to control the thrusting direction of the engine. Using this guidance law, the vehicle will fly in a trajectory neighboring the nominal trajectory. The extended Kalman filter is used for state estimation. Finally a short mission using this system is simulated. The results indicate that this system is very efficient for short missions. Author

N74-27170*# Scientific Translation Service, Santa Barbara, Calif.
BAD WEATHER LANDING TODAY: ITS PROBLEMS AND LIMITATIONS
D. Brunner Washington NASA 12 Jun. 1974 14 p Transl. into ENGLISH from DGLR-DGON Symp. on Nele Anflugund Landeverfahren, Dusseldorf, DGLR-Paper-73-015, 2-4 May 1973 11 p
(Contract NASw-2483)
(NASA-TT-F-15610; DGLR-Paper-73-015) Avail: NTIS HC $4.00 CSCL 17G

The limitations of Instrument Landing System (ILS) approach procedures are discussed for various categories of landing conditions. Legal aspects and procedures for category 1, 2, and 3 conditions are described. Deficiencies of existing systems for poor weather conditions are elaborated and remedies suggested. Relationships between landing requirements, weather conditions, and traffic flow and density are established. Author

N74-27171*# Kanner (Leo) Associates, Redwood City, Calif.
SAFETY DURING AUTOMATIC LANDING WITH POOR VISIBILITY
J. P. DeBeauchene Washington NASA Jun. 1974 23 p Transl. into ENGLISH from Navigation (Paris), v. 22, Jan. 1974 p 31-46
(Contract NASw-2481)
(NASA-TT-F-15715) Avail: NTIS HC $4.25 CSCL 17G

The performance of automatic pilot systems during aircraft approach and landing is discussed. Emphasis is placed on the flight safety aspects and limitations of the systems under low visibility conditions. The components and operating principles of the instrument landing system (ILS) are analyzed. Examples of automatic pilot systems installed in various transport aircraft are illustrated. Author

N74-27172# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
NEW METHODS FOR COMMAND AND STABILITY AUGMENTATION VIA OPTIMAL CONTROL
Eliezer Kreindler (Technion - Israel Inst. of Tech.) and David Rothschild Apr. 1974 62 p refs
(RE-472) Avail: NTIS HC $6.25

An implicit model following design technique is presented based on linear optimal control, that is particularly effective for complicated flight control situations with many controls and with difficult design specifications. The procedure involves defining the quadratic performance index to be minimized in such a way that precludes on-board generation of desired handling quality model dynamics. This complex performance index yields feedback and feedforward control gain solutions which implicitly force the actual system to follow the desired response. It is shown that in addition to the advantage of reduced complexity with respect to implementation, the implicit approach leads to improved short period transient response. Resulting closed-loop eigenvalues can be forced arbitrarily close to those of the desired model. Author

N74-27173# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FALSE TARGET ELIMINATION AT ALBUQUERQUE USING ARTS-3 SOFTWARE
Alan G. Cameron 12 Mar. 1974 30 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-776798; TN-1974-12; ESD-TR-74-134) Avail: NTIS CSCL 17/7

Lincoln Laboratory has been assisting the U.S. Air Force Weapons Laboratory in the study of ATCRBS false targets caused by reflections from buildings at Albuquerque International Airport/Kirtland AFB. This paper discusses the false target situation there and proposes two algorithms for correcting it in ARTS-III software. The simpler of the two appears applicable to the Albuquerque situation today, and is easily extendable to correct false targets caused by new buildings. Since the process appears directly applicable to many FAA Secondary Radar installations, a more complex algorithm is also presented, which is suitable for use in very high density terminal areas. Author (GRA)

N74-27174# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MODELS OF MULTIPATH PROPAGATION EFFECTS IN A GROUND-TO-AIR SURVEILLANCE SYSTEM
T. P. McGarty 25 Feb. 1974 156 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002)
(AD-777241; TN-1974-7; ESD-TR-74-40) Avail: NTIS CSCL 17/7

Models are developed for the electromagnetic propagation of diffuse and specular multipath for a surface-to-air ATC radar beacon link. The models take into account geometrical, topographical, electrical, and surface characteristics of the multipath

propagation environment. The models are used to evaluate signal fading and azimuth estimation performance of a monopulse processor in a ground-based interrogator. The results are applied to assessing the performance of the DABS sensor. Conclusions and recommendations for experimental work are presented.
Author (GRA)

N74-27175# Northrop Corp., Norwood, Mass. Precision Products Dept.
ADDITIONAL LONG-TERM GYROCOMPASS TEST RESULTS Final Report, Mar. - Jun. 1973
K. W. Millo 31 Dec. 1973 21 p refs
(Contract F19628-73-C-0034; AF Proj. 7628)
(AD-777145; AFCRL-TR-74-0124) Avail: NTIS CSCL 17/7
The report details the test instrumentation, the test environment, and the test results in the areas of long term agreement with the Astro reference and the effects of test pad tilt. GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-27176*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMIONIC PERFORMANCE OF A CESIUM DIMINIODE WITH RELATIVELY IMPURE 110-TUNGSTEN ELECTRODES
Arthur L. Smith, Eugene J. Manista, and James F. Morris Washington Jun. 1974 13 p refs
(NASA-TM-X-3021; E-7894) Avail: NTIS HC $3.00 CSCL 18A
Thermionic performance data from a miniature plane cesium diode (diminiode) with 110-tungsten electrodes are presented. The diminiode has a guard-ringed collector and a spacing of 0.23 mm. The data were obtained by using a computerized acquisition system. The diode was tested at increments between 1700 and 1900 K for the emitter, 694 and 1101 K for the collector, and 519 and 650 K for the reservoir. A maximum power density of 4.5 W/sq cm was obtained at an emitter temperature of 1900 K. This relatively low output probably results from high carbon and sodium impurities in the electrode materials. Author

N74-27177*# Battelle Columbus Labs., Ohio.
OUT-OF-PILE CREEP BEHAVIOR OF URANIUM CARBIDE Summary Report, 1 Jul. 1972 - 30 Jun. 1973
T. R. Wright and M. S. Seltzer [1974] 100 p refs
(Contract NAS3-16776)
(NASA-CR-134588) Avail: NTIS HC $8.00 CSCL 18J
Compression creep tests were investigated on various UC-based fuel materials having a variation in both density and composition. Specimens were prepared by casting and by hot pressing. Steady-state creep rates were measured under vacuum at 1400 to 1800 C in the stress range 500-4000 psi. Author

N74-27178# Naval Research Lab., Washington, D.C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Semiannual Progress Report, 1 Aug. 1973 - 31 Jan. 1974
Lendell E. Steele Mar. 1974 74 p refs
(RR0221141)
(AD-777433; NRL-MR-2752) Avail: NTIS CSCL 18/1
The report includes: (1) effect of hold-time on fatigue crack propagation in thermally aged, annealed and 25% cold-worked 304 stainless steel; (2) notch ductility retention of A543 submerged arc and electroslag weld deposits after irradiation; (3) temperature and dose rate dependence of void nucleation and growth in heavy ion bombarded nickel; (4) studies of the mobility of helium in vanadium; (5) effect of cyclotron-implanted helium on the fatigue behavior of 316 stainless steel; and (6) notch toughness of irradiated 316 stainless steel weld. (Modified author abstract) GRA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-27179 National Bureau of Standards, Washington, D.C. Building Environment Div.
COLORIMETRY AND SPECTROPHOTOMETRY: A BIBLIOGRAPHY OF NBS PUBLICATIONS, JANUARY 1906 THROUGH JANUARY 1973
Kenneth L. Kelly Apr. 1974 56 p refs
(NBS-SP-393) Avail: SOD HC $0.95 as C13.10:393
The bibliography of 623 publications serves as the key to the large amount of research into color measurement and specification, and color vision carried out in colorimetry and spectrophotometry investigations. The practical value of this wealth of information lies in its ready accessibility to the scientific and technical fraternity by title, by key words or by author, in the Library of Congress, and in depository libraries such as large public and university libraries. A short organizational chronology of the colorimetry and spectrophotometry program is included.
Author

N74-27180 Stanford Univ., Calif.
COMPUTER GENERATION OF COHERENT OPTICAL FILTERS WITH HIGH LIGHT EFFICIENCY AND LARGE DYNAMIC RANGE Ph.D. Thesis
Mete Severcan 1974 137 p
Avail: Univ. Microfilms Order No. 74-13687
Two techniques for making computer generated spatial filters with high dynamic range and high light efficiency are described, and a general treatment of computer generated holograms is given. Phase-only filters with continuous phase control are realized by adding to the desired complex amplitude an auxiliary function which effectively maps the amplitude part of the transmittance into a phase-only function. At the output of the system, the auxiliary function results in redundant information which is spatially separated from the desired image and therefore can easily be removed. Two different implementations of this idea are proposed, one a two-channel system and the second a single-channel system. Dissert. Abstr.

N74-27181*# New York Univ., N.Y. Center for Interdisciplinary Programs.
FLUID DYNAMIC ASPECTS OF JET NOISE GENERATION Final Technical Report, 1 Sep. 1972 - 30 Sep. 1973
30 Sep. 1973 36 p refs
(Grant NGR-33-016-177)
(NASA-CR-138623) Avail: NTIS HC $5.00 CSCL 20A
The propagation of sound waves inside a jet (single or multiple) was studied with particular attention to refraction of ray trajectories and distortion of wave profile due to nonlinear effects. An experimental method is used in studying this phenomenon which consists of injecting from outside the jet, at one or various points near the mixing zone, a set of pressure signals, and detecting them with one or more microphones placed inside the jet. The signals are detected in the presence of the background noise of the jet itself. Signal processing and instrumentation are discussed along with noise detection. Author

N74-27182*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
MONTE CARLO INVESTIGATION OF TRANSIENT ACOUSTIC FIELDS IN PARTIALLY OR COMPLETELY BOUNDED MEDIUM Ph.D. Thesis
Balakrishna Dattatraya Thanedar Oct. 1972 370 p refs
(Grants NGR-47-005-085; NGR-47-005-108)
(NASA-CR-138655) Avail: NTIS HC $21.50 CSCL 20A
A simple repetitive calculation was used to investigate what happens to the field in terms of the signal paths of disturbances originating from the energy source. The computation allowed the field to be reconstructed as a function of space and time on a statistical basis. The suggested Monte Carlo method is in response to the need for a numerical method to supplement analytical methods of solution which are only valid when the

boundaries have simple shapes, rather than for a medium that is bounded. For the analysis, a suitable model was created from which was developed an algorithm for the estimation of acoustic pressure variations in the region under investigation. The validity of the technique was demonstrated by analysis of simple physical models with the aid of a digital computer. The Monte Carlo method is applicable to a medium which is homogeneous and is enclosed by either rectangular or curved boundaries. Author

N74-27183*# Maryland Univ., College Park. Computer Science Center.
A QUANTITATIVE STUDY OF THE ORIENTATION BIAS OF SOME EDGE DETECTOR SCHEMES
J. R. Fram and E. S. Deutsch Jan. 1974 40 p refs
(Grant NGR-21-002-351)
(NASA-CR-138665; TR-285) Avail: NTIS HC $5.00 CSCL 20F

The evaluation of a particular set of edge detection schemes is described. The results obtained are compared with those obtained from an edge detection scheme using a texture oriented approach. The orientational bias of these schemes is emphasized. Improved qualitative observations are reported and a comparison of the evaluation method with another edge detection evaluation method is presented. Author

N74-27184# National Bureau of Standards, Washington, D.C. Heat Div.
NBS CRYOGENIC THERMOMETRY AND THE PROPOSED CRYOGENIC EXTENSION OF THE IPTS Final Report
G. Cataland, R. P. Hudson, B. W. Mangum, H. Marshak, H. H. Plumb, J. F. Schooley, R. J. Soulen, Jr., and D. B. Utton May 1974 34 p refs
(NBS-TN-830; LC-74-600073) Avail: SOD HC $0.65 as C13.46:830

A comprehensive and long-term program being carried out by NBS scientists of the cryogenic physics and temperature sections is outlined. The goals of the program are the extension of IPTS 68 below 13.81 K and the development of devices which make practical realizations of that scale convenient and reliable. It is proposed to contribute to international adoption of a thermodynamically accurate scale below 13.81K by analyzing the results of three thermometers: the NBS Acoustical Thermometer (already in operation for several years), noise thermometry using the Josephson effect (recently developed), and gamma-ray anisotropy thermometry (recently studied in detail at NBS). Such a temperature scale will most likely be disseminated by the use of certain superconductors as thermometric reference points. Practical interpolation devices will be based on the principles of nuclear and electronic paramagnetism, nuclear quadrupole resonance, and nuclear magnetic resonance. Details of operation, measurement schemes and experimental progress made to date are included. Author

N74-27185*# North American Rockwell Corp., Downey, Calif. Space Div.
MEASUREMENT COMPONENT TECHNOLOGY. VOLUME 1: CRYOGENIC PRESSURE MEASUREMENT TECHNOLOGY, HIGH PRESSURE FLANGE SEALS, HYDROGEN EMBRITTLEMENT OF PRESSURE TRANSDUCER MATERIAL, CLOSE COUPLED VERSUS REMOTE TRANSDUCER INSTALLATION AND TEMPERATURE COMPENSATION OF PRESSURE TRANSDUCERS Final Report
K. K. Hayakawa, D. R. Udell, M. M. Iwata, C. F. Lytle, R. M. Chrisco, C. S. Greenough, and J. A. Walling 13 Oct. 1972 152 p refs
(Contract NAS7-200)
(NASA-CR-120226; SD-72-SA-0156-1) Avail: NTIS HC $10.75 CSCL 20L

The results are presented of an investigation into the availability and performance capability of measurement components in the area of cryogenic temperature, pressure, flow and liquid detection components and high temperature strain gages. In addition, technical subjects allied to the components were researched and discussed. These selected areas of investigation were: (1) high pressure flange seals, (2) hydrogen embrittlement of pressure transducer diaphragms, (3) The effects of close-coupled versus remote transducer installation on pressure measurement, (4) temperature transducer configuration effects on measurements, and (5) techniques in temperature compensation of strain gage pressure transducers. The purpose of the program was to investigate the latest design and application techniques in measurement component technology and to document this information along with recommendations for upgrading measurement component designs for future S-2 derivative applications. Recommendations are provided for upgrading existing state-of-the-art in component design, where required, to satisfy performance requirements of S-2 derivative vehicles. Author

N74-27186*# North American Rockwell Corp., Downey, Calif. Space Div.
MEASUREMENT COMPONENT TECHNOLOGY. VOLUME 2: CRYOGENIC FLOW MEASUREMENT AND CRYOGENIC LIQUID DETECTION MEASUREMENT TECHNOLOGY Final Report
K. K. Hayakawa, D. R. Udell, M. M. Iwata, C. F. Lytle, R. M. Chrisco, C. S. Greenough, and J. A. Walling 13 Oct. 1972 93 p refs
(Contract NAS7-200)
(NASA-CR-120227; SD-72-SA-0156-2) Avail: NTIS HC $7.75 CSCL 20L
For abstract, see N74-27185.

N74-27187*# North American Rockwell Corp., Downey, Calif. Space Div.
MEASUREMENT COMPONENT TECHNOLOGY. VOLUME 3: CRYOGENIC TEMPERATURE MEASUREMENT AND HIGH TEMPERATURE STRAIN GAGE TECHNOLOGY Final Report
K. K. Hayakawa, D. R. Udell, M. M. Iwata, C. F. Lytle, R. M. Chrisco, C. S. Greenough, and J. A. Walling 13 Oct. 1972 110 p refs
(Contract NAS7-200)
(NASA-CR-120228; SD-72-SA-0156-3) Avail: NTIS HC $8.50 CSCL 20L
For abstract, see N74-27185.

N74-27188# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CHARACTERISTIC LOSSES OF ELECTRONS IN TICl, TIBr, TII AND CALCULATION OF OPTICAL FUNCTIONS BETWEEN 3 AND 25 eV
J. Frandon and B. Lahaye Dec. 1972 16 p refs Transl. into ENGLISH from J. Phys. (France), v. 33 no. 2-3, 1972 p 229-235
(NTC-74-11869; Rept-73-28) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The characteristic energy losses undergone by a beam of 20-keV electrons in traversing films of TICl, TIBr and TII were measured with a magnetic spectrograph. The optical constants are calculated by a Kramer-Kronig analysis and are compared with absorption and reflectance measurements. The spectra are interpreted by means of a recent calculation of the band structure. Author

N74-27189# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REMARKS CONCERNING THE SCATTERING OF LIGHT AND ELECTROMAGNETIC WAVES BY FREE ELECTRONS
Ch. Fabry Jul. 1973 6 p Transl. into ENGLISH from Compt. Rend. Acad. Sci. Paris (Paris), v. 187, no. 19, 1928 p 777-781
(NTC-74-11886; Rept-73-153) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

In calculating the electromagnetic scattering, it is assumed that the laws of classical mechanics and electrodynamics are applicable without the intervention of quanta. The basic premise for the method of calculation is that across an area in the wave plane there is transmitted a quantity of energy per second, or power, which is proportional to this area; and (2) if an electron is interposed on this wave, it scatters a certain power which can be expressed by calculating the area of the wave plane which would transmit this same power. The equations involved are given and their applications discussed. D.L.G.

N74-27190*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
ASRDI OXYGEN TECHNOLOGY SURVEY. VOLUME 4: LOW

TEMPERATURE MEASUREMENT
Larry L Sparks Washington NASA 1974 167 p refs Sponsored by NASA
(NASA-SP-3073) Avail: NTIS HC $5.00 CSCL 20L

Information is presented on temperature measurement between the triple point and critical point of liquid oxygen. The criterion selected is that all transducers which may reasonably be employed in the liquid oxygen (LO2) temperature range are considered. The temperature range for each transducer is the appropriate full range for the particular thermometer. The discussion of each thermometer or type of thermometer includes the following information: (1) useful temperature range, (2) general and particular methods of construction and the advantages of each type, (3) specifications (accuracy, reproducibility, response time, etc.), (4) associated instrumentation, (5) calibrations and procedures, and (6) analytical representations. Author

N74-27191*# Texas A&M Univ., College Station. Dept. of Physics.
INTERIOR RADIANCES IN OPTICALLY DEEP ABSORBING MEDIA. 3: SCATTERING FROM HAZE L
George W. Kattawar and Gilbert N. Plass 13 Jun. 1974 57 p refs Submitted for publication
(Grant NGR-44-001-117)
(NASA-CR-138521; Rept-9) Avail: NTIS HC $6.00 CSCL 20F

The interior radiances are calculated within an optically deep absorbing medium scattering according to the Haze L phase function. The dependence on the solar zenith angle, the single scattering albedo, and the optical depth within the medium is calculated by the matrix operator method. The development of the asymptotic angular distribution of the radiance in the diffusion region is illustrated through a number of examples; it depends only on the single scattering albedo and on the phase function for single scattering. The exact values of the radiance in the diffusion region are compared with values calculated from the approximate equations proposed by Van de Hulst. The variation of the radiance near the lower boundary of an optically thick medium is illustrated with examples. The attenuation length is calculated for various single scattering albedos and compared with the corresponding values for Rayleigh scattering. The ratio of the upward to the downward flux is found to be remarkably constant within the medium. The heating rate is calculated and found to have a maximum value at an optical depth of two within a Haze L layer when the sun is at the zenith. Author

N74-27192*# Arizona Univ., Tucson. Engineering Experiment Station.
A DIRECT APPROACH TO THE DESIGN OF LINEAR MULTIVARIABLE SYSTEMS Annual Report
Bajarang Lall Agrawal Jun. 1974 150 p refs
(Grant NGL-03-002-006)
(NASA-CR-138516) Avail: NTIS HC $10.50 CSCL 20F

Design of multivariable systems is considered and design procedures are formulated in the light of the most recent work on model matching. The word model matching is used exclusively to mean matching the input-output behavior of two systems. The term is used in the frequency domain to indicate the comparison of two transfer matrices containing transfer functions as elements. Design methods where non-interaction is not used as a criteria were studied. Two design methods are considered. The first method of design is based solely upon the specification of generalized error coefficients for each individual transfer function of the overall system transfer matrix. The second design method is called the pole fixing method because all the system poles are fixed at preassigned positions. The zeros of terms either above or below the diagonal are partially fixed via steady state error coefficients. The advantages and disadvantages of each method are discussed and an example is worked to demonstrate their uses. The special cases of triangular decoupling and minimum constraints are discussed. Author

N74-27193*# Texas Univ., Austin. Dept. of Electrical Engineering.
OPTICAL PROPERTIES OF MATERIALS AT LOW TEMPERATURE AND THEIR APPLICATION TO OPTICAL DETECTION Final Report
William H. Hartwig and Andrea Albanese Tarchi 31 Aug. 1972 81 p refs
(Grant NGR-44-012-104)
(NASA-CR-139027) Avail: NTIS HC $7.25 CSCL 20F

A lumped model to represent the photodielectric effect is developed. An analog simulation for a sample in a microwave cavity with a static magnetic field is developed. A system to measure continuously the PDE is analyzed. A performance factor to compared PD detectors versus ac photoconductors is computed. The operating conditions are defined for the appropriate noise conditions. The detectivity of the detector is found to be limited by the semiconductor sample noise. Author

N74-27194# Commissariat a l'Energie Atomique, Saclay (France). Centre dEtudes Nucleaires de Saclay.
CALCULATION OF BINDING ENERGIES IN DEFECT CLUSTERS
Dang Dinh Cung Nov. 1973 23 p refs In FRENCH
(CEA-R-4500) Avail: AEC Depository Libraries HC $3.25

Several theoretical models are suggested for evaluating the role of binding energy in point defects and determining the influence of such defects on the mechanical properties of materials. Calculations were simplified by considering numerous approximations and the properties of crystal symmetry. Transl. by E.H.W.

N74-27195# Illinois Univ., Urbana.
MAGNETISM IN Ni-Cu AND Co-Re SOLID SOLUTIONS
S. Mishra, E. J. Hayes, R. Tustison, and P. A. Beck 1973 3 p refs Presented at the Intern. Conf. on Disordered Alloys, Strasbourg, Sep. 1973 Sponsored by AEC and NSF
(COO-1198-1026; Conf-730977-1) Avail: NTIS HC $3.00

Recent work with a virtually iron-free superparamagnetic Ni-Cu alloy resulted in the analysis of the magnetization measured as a function of field in the temperature range from 1.5 K to room temperature in terms of a field- and temperature-independent susceptibility and two Brillouin functions corresponding to average magnetic cluster moments. Similar work was performed on an iron-free paramagnetic alloy and virtually iron-free ferromagnetic alloys with 42, 45, and 48 percent Ni. Results on Co-Re show the existence of a continuous solid solution phase field all the way from the low temperature modification of Co to Re. Moment assignments were determined. NSA

N74-27196# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
ACOUSTIC EMISSION SOURCE LOCATION ON A NON-SPHERICAL SURFACE OF REVOLUTION
V. E. Sackschewsky and L. A. Lott 19 Nov. 1973 17 p refs
(Contract AT(29-1)-1106)
(RFP-2090) Avail: NTIS HC $4.00

Described is a procedure to calculate the source location of an acoustic emission signal generated on a nonspherical surface, based on the arrival times of the signal at five transducers. The process assumes a smooth, closed surface of revolution, symmetric with respect to the equator and such that the radial distance, measured perpendicularly from the polar axis, is a strictly increasing function of the polar angle phi for 0 deg less than or equal to phi less than or equal to 90 deg. Listings and sample runs of the computer programs are included. The accuracy of the procedure was tested using simulated timing data for a sphere. The average distance between the true and calculated source location was 0.05% of the radius. The cycle time required to process one set of timing data is estimated to be 10 to 30 ms, depending on which version of the program is used. Author (NSA)

N74-27197# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
IMPROVEMENT OF PHOTOGRAPHIC AND OPTICAL SYSTEMS
S. Kelly 1973 9 p refs Sponsored by AEC
(Contract DA-11-173-AMC-487(A))
(MHSMP-73-43-K) Avail: NTIS HC $3.00

A method of obtaining sensitiometric data and plots using an analytical process is discussed. Calculations using this method agree well with results obtained by a manual method. A brief description is given of the modulation transfer function (MTF), how it is calculated, alternative methods for improving this

calculation and an experimental MTF curve from a lens test system currently being evaluated. Author (NSA)

N74-27198# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SIGNIFICANCE OF CONVECTION EFFECTS IN THE THEORY OF AERODYNAMIC SOUND GENERATION [DIE BERUECKSICHTIGUNG VON KONVEKTIONSEFFEKTEN IN DER THEORIE DER AERODYNAMISCHEN SCHALLERZEUGUNG]
G. Zimmermann Feb. 1974 18 p refs In GERMAN
(Rept-4/74) Avail: NTIS HC $4.00; Max-Planck-Inst. fuer Stroemungsforsch., Geottingen, West Ger. 6,60 DM

A mathematical expression for the sound generated by a turbulent flow in a limited area is derived for the case where the turbulent flow is superimposed on a basic flow. It is shown that the separation of turbulence and convection effects by transformation on a suitable convected coordinate system is accomplished only approximately or by introducing additional assumptions about the correlation tensor of the turbulent flow. The case in which the convection speed is constant is discussed in detail. ESRO

N74-27199# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Rechenzentrum.
CALCULATION OF THE MAGNETIC FLUX AND INDUCTIVITY OF AXIALLY SYMMETRIC COIL SYSTEMS
Dieter Faber and Armand Meert Jul. 1973 49 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-109) Avail: NTIS HC $5.50; DFVLR, Porz, West Ger. 17,80 DM

Starting from the magnetic field distribution generated by an axially symmetric coil with arbitrary directrix and current distribution along this directrix, the magnetic flux and the inductivity of the coil were calculated. In particular, numerical computations were carried out for cylindrical coils with a spatially sinusoidal current distribution. The mathematical section presents the required existence proofs and a special commutation rule for limiting process and integration, for which no equivalent theorem exists in the literature. The physical section sets up suitable mathematical formulations including their applications. Numerical results are shown graphically. Author (ESRO)

N74-27200# Kansas Univ., Lawrence. Dept. of Physics.
EXPERIMENTAL AND THEORETICAL STUDIES OF MAGNETIC RESONANCE AND RELAXATION WITH EMPHASES ON ONE DIMENSIONAL MAGNETISM Final Report, 1 Jun. 1970 - 30 Nov. 1973
Jack W. Culvahouse and Peter M. Richards 8 Mar. 1974 9 p refs
(Grant DA-ARO(D)-31-124-70-G74)
(AD-776411; AROD-8949-3-P) Avail: NTIS CSCL 20/12

Progress made under this grant during the period 1 June 1970 to 30 November 1973 toward understanding of magnetic materials is summarized with references to six papers and five Ph.D. theses completed during this period. The progress includes the following: New results on nuclear and electronic spin-waves obtained from measurement of the transient decay of magnetic resonance signals. New information on one dimensional magnetic materials (linear chains) from careful measurement of electron paramagnetic resonance lineshapes, for ((CH3)4 N)MnCl3, Cu(NH3)(SO4).H2O, CsMnCl3.2H2O, and CuCl2.2NC5H5. Progress was made in the application of the cluster model to Hubbard Hamiltonian. Methods were developed for the use of an on-line and interactive computer system to carry out precise measurements of magnetic resonance lineshapes. Author (GRA)

N74-27201# Cryogenic Technology, Inc., Waltham, Mass.
OPERATOR'S MANUAL SUPPLEMENT. MODEL 1400 SYSTEM FOR OFFICE OF NAVAL RESEARCH USN SHIP RESEARCH AND DEVELOPMENT CENTER IN ACCORD WITH CTi SPECIFICATION A3542561 Final Report
David McWilliams and Paul Doherty Mar. 1974 65 p
(Contract N00014-73-C-0468)
(AD-776248; CTI-A3542561) Avail: NTIS CSCL 13/1

A standard Model 1400 Refrigerator/Liquefier was modified to provide special features to simplify the interface with an experimental superconducting motor, and to incorporate flexibility to allow for the investigation of alternate refrigerator cycles. This manual supplement identifies the modifications and is intended to be used in addition to the standard Model 1400 Operator's Manual. Description, operating instructions, and parts identification for the additional assemblies are included. Test results and analysis related to preliminary work done at CTi are presented as a guide for initial use at the USN Ship Research and Development Center. Author (GRA)

N74-27202# Illinois Univ., Urbana. Electromagnetics Lab.
MICROWAVE INTEGRATED CIRCUITS, ELECTROMAGNETIC SCATTERING, AND OPTICAL DATA PROCESSING Final Report, 1 Feb. 1971 - 31 Jan. 1974
R. Mittra and T. Itoh Jan. 1974 16 p refs
(Grant DA-ARO(D)-31-124-71-G77; AROD Proj. 5405-E)
(AD-777018; UIEL-74-2; UILU-ENG-74-2539; AROD-5405-40-E) Avail: NTIS CSCL 05/2

Technical accomplishments in the various research projects sponsored by the Army Research Office under Grant No. DA-ARO-D-31-124-G77 are summarized. These projects include microwave integrated circuits, integrated optics, image processing, and numerical electromagnetics. A list of published articles is also included. Author (GRA)

N74-27203# Georgia Inst. of Tech., Atlanta.
HEAT PIPE COOLED MICROWAVE WINDOW Final Report
Gene T. Colwell, Harold L. Bassett, and James M. Schuchardt Feb. 1974 75 p refs
(Contract DAHC60-73-C-0068; GIT Proj. E-25-635; GIT Proj. A-1532)
(AD-776996) Avail: NTIS CSCL 09/1

The program centered around the examination and selection of suitable dielectric window materials for a heat pipe cooled microwave window and the selection of a working fluid. Two ceramic materials, aluminum oxide and beryllia, were found to be appropriate for window materials in the high average power microwave device. The aluminum oxide material does not possess thermal properties as desirable as the beryllia, but the aluminum oxide is less costly. A number of working fluids were found to have desirable properties, both thermal and microwave, and two of these were very good fluids, Heptane and Carbon Tetrachloride. An experimental heat pipe was constructed and tested as part of this program. The tests indicated that the heat pipe cooled windows could handle up to 2-3 megawatts of RF power at a frequency near 3.0 GHz. Author (GRA)

N74-27204# Washington Univ., Seattle. Lab. for Applied Electronic Sciences.
GARNET FILM OPTICS Annual Report
Marcel W. Muller, Sang-Koo Chung, Ming-Jan Sun, Jerry W. Moody, and Roger W. Shaw Feb. 1974 144 p refs Prepared in cooperation with Monsanto Co., Seattle
(Contract N00014-67-A-0445-0005; Grant NSF GH-32000; NR Proj. 009002)
(AD-777724; Rept-1974-1) Avail: NTIS CSCL 20/6

The work during the reporting period was concerned with two main tasks; The evaluation of epitaxially grown garnet films as passive thin film optical waveguide, and the study of magnetic domain structures in magnetic garnet films for possible application as passive and as field-controlled active components in integrated optical circuits. (Modified author abstract) GRA

N74-27205# Corning Glass Works, N.Y.
OPTIMIZATION OF OPTICAL WAVEGUIDES STRENGTH STUDIES Final Technical Report, Feb. 1973 - Mar. 1974
R. D. Maurer, R. A. Miller, D. D. Smith, and J. C. Trondsen 28 Mar. 1974 30 p refs
(Contract N00014-73-C-0293; NR Proj. 039-119)
(AD-777118) Avail: NTIS CSCL 20/6

A tensile test and testing procedures were developed and used to evaluate the effects of lubricants, coatings and reeling conditions on glass fiber strength. The results indicated that fiber failure always originated at surface imperfections and that the appropriate lubricants and coatings could preserve fiber strength by affording some degree of protection to the fiber surface. Fiber strength was also found to be a function of the

reeling parameters. Attempts to predict the strength of long lengths of fiber from short gage length data were inconclusive.
Author (GRA)

N74-27206# Rice Univ., Houston, Tex.
GENERATION AND DETECTION OF COHERENT AND INCOHERENT ELECTROMAGNETIC RADIATION Final Report, 15 Jul. 1968 - 14 Jul. 1973
14 Jul. 1973 11 p refs
(Contract N00014-68-A-0503)
(AD-777692) Avail: NTIS CSCL 20/6

The report briefly reviews research areas which were supported by this contract. Included are: Research and development of tunable coherent light sources, picosecond laser pulses, laser pulse measurement and mode locking theory, techniques for submillimeter generation and detection, development of gamma-ray telescopes, infrared detection, theoretical studies of gamma-ray optics, and experimental studies in vacuum UV, X-ray and gamma-ray optics. GRA

N74-27207# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A SIMPLE TECHNIQUE FOR RECORDING OPTICAL SIGNATURES
William E. Krag, Ramaswamy Sridharan, and Anthony J. Yakutis 20 Mar. 1974 24 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-777152; TN-1974-18; ESD-TR-74-137) Avail: NTIS CSCL 17/8

A simple method of observing and recording the optical signature of a satellite as displayed on a TV monitor is discussed. The technique is applied to the analysis of an ATS-5 synchronous satellite. The observations are compared with the calculations for the image intensity in an appendix. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-27208 Illinois Univ., Chicago.
ELECTRONIC TRANSITIONS OF MOLECULES CN AND LaO Ph.D. Thesis
Lambert Henry Schoonveld 1973 115 p
Avail: Univ. Microfilms Order No. 74-10381

Theoretical and experimental studies using spectroscopic techniques were made of several electronic transitions of two important diatomic molecules of astrophysical interest CN and LaO. The CN molecule is of wide spread occurrence including comets and solar spectra; and the spectrum of LaO was seen in M and S-type stars. The spectrum of the violet system of CN was photographed in high resolution. Bands that were observed previously but not analyzed as well as newly observed bands were analyzed in detail; and the rotational constants have been evaluated. These results plus those of earlier investigators are combined to perform a vibrational analysis. Dissert. Abstr.

N74-27209*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
CONTINUUM IONIZATION TRANSITION PROBABILITIES OF ATOMIC OXYGEN
James R. Samson and V. E. Petrosky [1973] 14 p refs
(Grant NGR-28-004-021; Grant NSF GA-36718)
(NASA-CR-138663) Avail: NTIS HC $4.00 CSCL 20H

The technique of photoelectron spectroscopy was used to obtain the relative continuum transition probabilities of atomic oxygen at 584 A for transitions from 3P ground state into the 4S, D2, and P2 states of the ion. Transition probability ratios for the D2 and P2 states relative to the S4 state of the ion are 1.57 + or - 0.14 and 0.82 + or - 0.07, respectively. In addition, transitions from excited O2(a 1 Delta g) state into the O2(+) (2 Phi u and 2 Delta g) were observed. The adiabatic ionization potential of O2(+)(2 Delta g) was measured as 18.803 + or - 0.006 eV. Author

N74-27210# Maryland Univ., College Park. Dept. of Physics and Astronomy.
SCATTERING OF GAUGE BOSONS IN SIXTH ORDER AND NON-RENORMALIZABILITY OF MASSIVE YANG-MILLS THEORIES
R. N. Mohapatra, S. Sakakibara, and J. Sucher May 1974 32 p refs
(Grants NSF GP-418-22X; NSF GP-20709)
(TR-74-102) Avail: NTIS HC $4.75

We consider the unitarity relation in 6th order g for the canonically quantized massive Yang-Mills theory. The three-particle intermediate state contribution to the absorptive part T sub 22 = T(W sub a + W sub b yields W sub c + W sub d) is re-expressed in terms of the absorptive parts of Feynman diagrams constructed using only soft propagators. The vertices which appear in this decomposition of Abs T sub 22 are the usual ones which occur in 4th order g, together with two new vertices of dimension five which couple a W to three ghost particles; these vertices are similar to those found by Veltman in his study of radiative corrections to the W-propagator. It is shown that, as a consequence, the Feynman rules proposed recently by Hsu and Sudarshan for the a quantized massive Yang-Mills theory do not yield a unitary S-matrix. The result is in harmony with Boulware's formal argument that such theories are not renormalizable. Author

N74-27211# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON THE POSITION OF THE MAXIMUM OF THE YIELD CURVE IN SECONDARY ELECTRON EMISSION
I. Buchholz Feb. 1973 19 p refs Transl. into ENGLISH from Z. Phys. (West Germany), v. 227, no. 5, 1969 p 440-452
(NTC-74-11912) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

There exists a quantitative connection between penetration depth of primary electrons, the maximum escape depth of secondary electrons and the the position of the maximum of the yield curve if one assumes: (1) the maximum of the yield curve is determined by an energy E(max) sub p of the primary electrons where the maximum penetration depth of primary electrons equals the maximum escape depth of the secondary electrons; and (2) the maximum escape depth of secondary electrons is given by about 10 atomic layers for all metals investigated as has been found previously by Mayer and Holzl for potassium. These assumptions are confirmed experimentally by measurements of yield curves and energy distributions at defined conditions and by variation of several parameters such as temperature, surface contamination, surface roughness, evaporation conditions and angle of incidence of the primary electrons. Author

N74-27212# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHENOMENOLOGICAL MODELS OF ELECTRON-PHONON INTERACTION AND THE CRITERION OF METAL SUPERCONDUCTIVITY
E. A. Pashitskiy Apr. 1973 75 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 17, no. 6, 1972 p 889-902
(NTC-74-11915; Rept-73-114) Avail: NTIS HC $4.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Isotropic model of a metal is investigated. A formula is obtained for critical temperature of superconductive transition T sub c and a numerical analysis T sub c is made of T sub c dependence on elastic lattice constants (sound velocity) and electron concentration (number of free electrons per atom). It is shown that theoretical values of critical temperature and isotope shift index are in satisfactory quantitative agreement with experimental values for most of non-transition metals, and the dependence of T sub c on the concentration of conduction electrons is in qualitative agreement with the empirical dependence of the superconductive transition temperature on the average number of valence electrons on melts of solid solution type. Author

N74-27213# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPERIMENTAL ARRANGEMENT FOR OBTAINING SECONDARY ELECTRON EMISSION SPECTRA OF METALS AND SEMICONDUCTORS
M. Salmeron, A. Baro et al Jan. 1973 5 p refs Transl. into ENGLISH from An. Fis. (Madrid), v. 67, no. 9-10, 1971

p 405-407
(NTC-74-11880; Rept-73-50) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The energy distribution of the secondary electrons emitted by a solid under electron bombardment was investigated by comparison with the results of various theories. The emission spectrum is studied because of the structure which is observed in the curves. Author

N74-27214# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFLUENCE OF ELECTRON BOMBARDMENT AND BAKING CYCLES ON THE SECONDARY EMISSION FROM LEAD GLASSES USED IN TUBE MULTIPLIERS
K. Steiner, P. Hafner et al Jan. 1973 4 p refs Transl. into ENGLISH from Z. Angew. Math. Phys. (Switzerland), v. 22, 1971 p 789-791
(NTC-74-11855; Rept-73-51) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Lead glasses for the tube multipliers were bombarded by electrons and baked at various temperatures. Attempts were then made to determine what effects, if any, such treatment had on secondary emission and surface resistance. Experimental data show that: (1) after baking for 10 hours at a temperature of 278 C secondary emission coefficients decreased by 10 to 20%, (2) surface resistance decreased about 50%, (3) electron bombardment causes a significant decrease in secondary emission, and (4) secondary emission depends on the bombardment charge per 2q mm. E.H.W.

N74-27215# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NONLINEAR NARROW RESONANCES IN THE DENSITY OF EXCITED MOLECULES IN A STANDING LIGHT WAVE
V. S. Letokhov and B. L. Pavlik May 1973 30 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Otd. Obshchei Fiz. i Astron., Inst. Spektrosk., Preprint No. 8, 1972 p 1-42
(NTC-74-50406; Rept-73-137) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Resonance variation in the total number of particles at the excited level is examined, when the field frequency passes through the center of a Doppler-broadened absorption line. This effect differs from the effect of the Lamb trough formation, since the latter is determined by the change in the distribution of particles by velocity at a given level. The total number of particles at an upper layer is determined by the total area of holes burned out by opposing traveling waves, and the Lamb trough is the result of the inequality of their depths at the center of the Doppler line. Author

N74-27216# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE BROADENING OF AN ELECTRON BEAM (17-1200 keV) BY MULTIPLE SCATTERING
L. Reimer, H. Gilde, and K. H. Sommer Jul. 1973 20 p refs Transl. into ENGLISH from Optik (West Germany), v. 30, no. 6, 1970 p 590-605
(NTC-74-11935; Rept-73-157) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The diameter of the electron beam and the broadening transverse to the beam caused by multiple scattering in a transmission electron scanning microscope is reported. For the case of limited apertures alpha, this paper reports Monte Carlo calculations that use scattering cross sections obtained from earlier experiments. Author

N74-27217*# Techtran Corp., Glen Burnie, Md.
A STUDY OF ELASTIC SCATTERING AND DEACTIVATION OF METASTABLE NITROGEN MOLECULES
A. P. Kalinin and V. B. Leonas Washington NASA Jun. 1974 14 p refs Transl. into ENGLISH of "Izucheniye Uprugogo Rasseyaniya i Dezaktivatsii Metastabilnykh Molekul Azota", Acad. Sci. of Sci. USSR, Moscow, Report Pr-161, 1974 14 p
(Contract NASw-2485)
(NASA-TT-F-15670; Pr-161) Avail: NTIS HC $4.00 CSCL 20H

The differential scattering of fast beams of nitrogen molecules on various targets are investigated. Anomalous behavior has been noted for the scattering of metastable molecules, which is connected with the quenching process. Scattering data have been used to determine anisotropic reaction potential parameters for the systems studied, in the range 0.1 - 50 eV. A quenching scheme via dissociation of the excited molecule is proposed. A calculation of the scattering pattern has been made in the classical approach which agrees with the measurements. Author

N74-27218*# Toledo Univ., Ohio.
CALCULATION OF TOTAL ELECTRON EXCITATION CROSS-SECTIONS AND PARTIAL ELECTRON IONIZATION CROSS-SECTIONS FOR THE ELEMENTS Ph.D. Thesis
T. J. Green Dec. 1973 216 p refs
(Grant NGR-36-010-017)
(NASA-CR-138629) Avail: NTIS HC $14.00 CSCL 20H

Computer programs were used to calculate the total electron excitation cross-section for atoms and the partial ionization cross-section. The approximations to the scattering amplitude used are as follows: (1) Born, Bethe, and Modified Bethe for non-exchange excitation; (2) Ochkur for exchange excitation; and (3) Coulomb-Born of non-exchange ionization. The amplitudes are related to the differential cross-sections which are integrated to give the total excitation (or partial ionization) cross-section for the collision. The atomic wave functions used are Hartree-Fock-Slater functions for bound states and the coulomb wave function for the continuum. The programs are presented and the results are examined. Author

N74-27219# Stuttgart Univ. (West Germany). Inst. fuer Kernenergetik.
ESTOQ: A PROGRAM FOR THE CALCULATION OF PRIMARY SHOCK SOURCES FOR AVOIDANCE OF THE RAY EFFECT IN TWO-DIMENSIONAL S SUB N CALCULATIONS [ESTOQ - EIN PROGRAMM ZUR BERECHNUNG VON ERSTSTOSSQUELLEN ZUR VERMEIDUNG DES RAY-EFFEKTS BEI ZWEIDIMENSIONALEN SN-RECHNUNGEN]
W. Klumpp, G. Pfister, and G. Rexer Aug. 1973 85 p refs In GERMAN
(IKE-4-17) Avail: NTIS HC $7.25

A computer program ESTOQ, for the calculation of primary impulse sources is discussed. The Ray effect is avoided in the two-dimensional S sub N calculations. A primary impulse theory is given and numerical calculation of the impulse moments is detailed. The computer program is duscussed and test calculations are evaluated. Improvements in the analysis of the collimator geometry are proposed. ESRO

N74-27220# Texas Univ., Austin. Dept. of Physics.
THEORETICAL STUDY OF THE EFFECTIVE POLARIZABILITY OF ADSORBED MOLECULES ON METAL SURFACES
Peter R. Antoniewicz 3 Apr. 1974 11 p refs
(Contract N00014-67-A-0126-0018)
(AD-777053; TR-1) Avail: NTIS CSCL 07/4

Atoms adsorbed on a metal surface acquire an induced dipole moment. An argument is presented which leads to a new mechanism responsible for these induced dipole moments. Author (GRA)

N74-27221# Aerospace Corp., El Segundo, Calif. Lab Operations.
PARTICLE LIFETIMES IN STRONG DIFFUSION Technical Report, Jun. 1973 - Feb. 1974
Michael Schulz 31 Mar. 1974 19 p refs
(Contracts F04701-73-C-0074; N00014-73-C-0333)
(AD-777576; TR-74(4260-20)-9) Avail: NTIS CSCL 04/1

The mean lifetime tau of a particle distribution, driven to isotropy by intense pitch-angle diffusion, is calculated by analytical means for conditions applicable to the earth's magnetosphere. The resulting algebraic expressions reduce to tau approximately = (64La/35v((alpha sub c)squared)(1-eta)) in the limit of a small equatorial loss cone (half-angle alpha sub c), where v is the particle speed, L is the magnetic shell parameter, a is the radius of the earth, and eta is the particle albedo from the atmosphere at either foot of the field line. Distinction is made in the full expressions for tau between complete isotropy (caused by strong pitch-angle diffusion all along the field line) and incomplete isotropy (caused by strong diffusion that is localized at the magnetic equator) over the upward hemisphere in velocity space. Author (GRA)

N74-27222# Intelcom Rad Tech, San Diego, Calif.
COLLISIONS BETWEEN GAS ATOMS AND SURFACES AS RELATED TO HIGH-ALTITUDE AERODYNAMICS Final Report, 1 Oct. 1968 - 31 Oct. 1973
Joe N. Smith, Jr. Dec. 1973 75 p refs
(Contract F44620-69-C-0034; AF Proj. 9783)
(AD-777221; RT-8003-001; AFOSR-74-0584TR) Avail: NTIS CSCL 07/4

The report outlines experimental research concerned with several areas of non-reactive atom-surface interactions, performed with modulated molecular-beam techniques. Included are general scattering studies from Mg(0001), Ag(001), Si(111) and macroscopically rough surfaces; atom diffraction from LiF(001); rainbow scattering from LiF(001); symmetry in gas-surface interactions; and determination of surface Debye temperatures using atom-beam scattering as a probe. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-27223 Maryland Univ., College Park.
MICROWAVE STUDIES OF MAGNETICALLY INDUCED MOMENTUM COUPLING IN LASER PRODUCED PLASMAS Ph.D. Thesis
Augustine Yim-Pan Cheung 1973 96 p
Avail: Univ. Microfilms Order No. 74-12817

The effect of a magnetic field on momentum coupling interactions between counterstreaming plasmas was studied by allowing a laser-produced copper plasma to expand into photoionized low-pressure background of heavy gases (Argon and Xenon) in the presence of a 700 Gauss transverse magnetic field. The choice of Argon and Xenon is based on theoretical results which indicates that conditions with copper plasma expanding into such gases at a velocity of 10 to the 7th power centimeters per second are free from collisional interferences. Experimental measurements were made with electrical diagnostics at radii on the order of 10 cm away from the point of plasma production. At such radii, diagnostics capable of spatial and temporal resolution on the order of .5 cm and 50 nanoseconds are required. A single wire microwave interferometer system, capable of giving better than .5 cm and 50 nanoseconds spatial and temporal resolutions at x-band frequencies has been built and calibrated from electron density measurements. Dissert. Abstr.

N74-27224 California Univ., Los Angeles.
FEEDBACK STABILIZATION OF PLASMAS Ph.D. Thesis
Guillermo Rodriguez 1974 174 p
Avail: Univ. Microfilms Order No. 74-12469

Some aspects of the control theory for systems describable by partial differential equations are developed and applied to solve a class of plasma stabilization problems governed by the ideal MHD equations. The basic plasma stabilization problem is formulated as a nonhomogeneous mixed initial-boundary-value (NMIBV) problem. The existence and uniqueness of generalized solutions to this problem are established. A set of eigenfunctions is defined, and its completeness is established. Consequently, the solutions to the NMIBV problem can be expanded in terms of these eigenfunctions. The question of controllability is studied, and it is established that all plasma motions which perturb the plasma surface can be controlled in principle. Various classes of stabilizing and optimal controls are derived. Dissert. Abstr.

N74-27225 New York Univ., N.Y.
PHOTONEUTRINO REACTION IN A SUPERSTRONG MAGNETOACTIVE PLASMA Ph.D. Thesis
Chih Kang Chou 1973 97 p
Avail: Univ. Microfilms Order No. 74-13313

Photoneutrino emission in a superstrong magnetoactive degenerate electron plasma is discussed in the language of quantum field theory. The photoneutrino luminosity due to the various modes of plasmon excitations at an arbitrary angle relative to the static homogeneous magnetic field is analyzed. The general results are applied to the important special cases for propagation of transverse plasmons along or across the external magnetic field. Dissert. Abstr.

N74-27226*# Princeton Univ., N.J. Guggenheim Aerospace Propulsion Labs.
PULSED ELECTROMAGNETIC GAS ACCELLERATION Semiannual Report, 1 Jan. - 30 Jun. 1973
Robert G. Jahn Jul. 1973 113 p refs
(Grant NGL-31-001-005)
(NASA-CR-138622; SAR-634u) Avail: NTIS HC $8.75 CSCL 20I

Direct measurement with thermocouples of the power deposited in the anode of a multi-megawatt magnetoplasmadynamic discharge has shown the fractional anode power to decrease from 50% at 200 kW to 10% at 20 MW. Using local measurements of current density, electric potential, and electron temperature, the traditional model for heat conduction to the anode is found to be inadequate. Other experiments in which the voltage-current characteristics and exhaust velocities of MPD arcs using Plexiglas and boron nitride chamber insulators and various mass injection configurations show that ablation can affect nominal accelerator operation in several distinct ways. The incorporation of a hollow cathode in a 7 kA plasma discharge has shown that a stable current attachment can be realized in the cavity without the aid of cathode heaters, keeper electrodes, or emissive coatings. Author

N74-27227# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE PROPAGATION OF SUB-MILLIMETER WAVES IN A SOLID STATE DRIFT PLASMA
Yu. G. Altshuler and L. I. Kats Mar. 1973 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Ukrania SSR), v. 15 no. 8, 1972 p 932-937
(NTC-74-11941; Rept-73-84) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The possibility of applying the electro-optical effects of magnetized solid state plasmas (SSP) for the construction of control structures for the sub-millimeter wave band were examined. The magnetic field determines the expression of the electro-optical effects and the type of waves, which propagate in the SSP, controlled by the propagation parameters occur by means of a variation of the external electric field. It is shown that the electro-optical phenomena, caused by the influence of a constant electric field on the propagation of a circularly polarized wave in a magneto-active solid state plasma, is very efficient in the sub-millimeter wave band. Author

N74-27228# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE INVESTIGATION OF THE TRANSMISSION OF A POWERFUL LASER BEAM THROUGH AN OPTICALLY DENSE PLASMA
V. S. Burakov, P. A. Naumenkov et al Mar. 1973 9 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 16, no. 2, 1972 p 239-242
(NTC-74-11950; Rept-73-93) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The transmission of ruby laser emission (density 1 million to 5 x 10 to the 8th power watts/cm sq, duration 3 x 10 to the minus 8th power sec) through a quasi-stationary plasma with a temperature of 3-4 eV and a comparatively high absorption coefficient (4-7/cm) was investigated. The mechanism of the observable illumination of the plasma is discussed. Author

N74-27229# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANISOTROPY OF PLASMA OSCILLATIONS IN GRAPHITE
K. Zeppenfeld May 1973 13 p refs Transl. into ENGLISH from Z. Phys. (West Germany), v. 211, 1968 p 391-399
(NTC-74-11909; Rept-73-131) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Energy loss spectra of electrons at different incidence angles relative to the crystal axis were measured in transmission of thin graphite single crystals. The spectra show that the energy and the intensity of the loss peaks are dependent on the angle between the momentum transfer and crystal axis. Author

N74-27230*# Stanford Univ., Calif. Inst. for Plasma Research.
VARIATIONAL CALCULATIONS FOR RESONANCE OSCIL-

LATIONS OF INHOMOGENEOUS PLASMAS
Y-K. M. Peng and F. W. Crawford Nov. 1973 40 p refs
(Grant NGL-05-020-176)
(NASA-CR-138648; SU-SUIPR-548) Avail: NTIS HC $5.00 CSCL 20I

The electrostatic resonance properties of an inhomogeneous plasma column are reported by application of the Rayleigh-Ritz method. A description of the rf equation of motion and pressure term that expresses the system of equations in Euler-Lagrange form is presented. The Rayleigh-Ritz procedure is applied to the corresponding Lagrangian to obtain approximate resonance frequencies and eigenfunctions. An appropriate set of trial coordinate functions is defined, which leads to frequency and eigenfunction estimates. Author

N74-27231*# Stanford Univ., Calif. Inst. for Plasma Research.
A MACROSCOPIC PLASMA LAGRANGIAN AND ITS APPLICATION TO WAVE INTERACTIONS AND RESONANCES
Yueng-Kay Martin Peng Jun. 1974 262 p refs
(Grants NGL-05-020-176; NSF GK-32788X)
(NASA-CR-138649; SU-SUIPR-575) Avail: NTIS HC $16.25 CSCL 20I

The derivation of a macroscopic plasma Lagrangian is considered, along with its application to the description of nonlinear three-wave interaction in a homogeneous plasma and linear resonance oscillations in a inhomogeneous plasma. One approach to obtain the Lagrangian is via the inverse problem of the calculus of variations for arbitrary first and second order quasilinear partial differential systems. Necessary and sufficient conditions for the given equations to be Euler-Lagrange equations of a Lagrangian are obtained. These conditions are then used to determine the transformations that convert some classes of non-Euler-Lagrange equations to Euler-Lagrange equation form. The Lagrangians for a linear resistive transmission line and a linear warm collisional plasma are derived as examples. Using energy considerations, the correct macroscopic plasma Lagrangian is shown to differ from the velocity-integrated low Lagrangian by a macroscopic potential energy that equals twice the particle thermal kinetic energy plus the energy lost by heat conduction. Author

N74-27232*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT ION PLASMA HEATING EXPERIMENTS IN SUMMA
J. J. Reinmann, M. R. Lauver, R. W. Patch, S. J. Posta, A. Snyder, and G. W. Englert 1974 42 p refs Presented at 1st Intern. Conf. on Plasma Sci., Knoxville, Tenn., 15-17 May 1974, Sponsored by IEEE
(NASA-TM-X-71559; E-7984) Avail: NTIS HC $3.25 CSCL 20I

Initial results are presented for the hot-ion plasma heating experiments conducted in the new SUMMA (superconducting magnetic mirror apparatus) at NASA Lewis Research Center. A discharge is formed by applying a radially inward dc electric field between cylindrical anodes and hallow cathodes located at the peak of the mirrors. Data were obtained at midplane magnetic field strengths from 1.0 to 3.5 tesla. Charge-exchange neutral particle energy analyzer data were reduced to ion temperatures using a plasma model that included a Maxwellian energy distribution superimposed on an azimuthal drift, finite ion orbits, and radial variations in density and electric field. The best ion temperatures in a helium plasma were 5 keV and in hydrogen the H2(+) and H(+) ions were 1.2 keV and 1 keV respectively. Optical spectroscopy line broadening measurements yielded ion temperatures about 50 percent higher than the charge-exchange neutral particle analyzer results. Spectroscopically obtained electron temperature ranged from 3 to 30 eV. Ion temperature was found to scale roughly linearly with the ratio of power input-to-magnetic field strength, P/B. Author

N74-27233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GUIDING CENTER MODEL TO INTERPRET NEUTRAL PARTICLE ANALYZER RESULTS
G. W. Englert, J. J. Reinmann, and M. R. Lauver 1974 21 p refs Presented at 1st Intern. Conf. on plasma Sci., Knoxville, Tenn., 15-17 May 1974; sponsored by IEEE
(NASA-TM-X-71555; E-7980) Avail: NTIS HC $3.00 CSCL 20I

The theoretical model is discussed, which accounts for drift and cyclotron components of ion motion in a partially ionized plasma. Density and velocity distributions are systematically precribed. The flux into the neutral particle analyzer (NPA) from this plasma is determined by summing over all charge exchange neutrals in phase space which are directed into apertures. Especially detailed data, obtained by sweeping the line of sight of the apertures across the plasma of the NASA Lewis HIP-1 burnout device, are presented. Selection of randomized cyclotron velocity distributions about mean azimuthal drift yield energy distributions which compared well with experiment. Use of data obtained with a bending magnet on the NPA showed that separation between energy distribution curves of various mass species correlate well with a drift divided by mean cyclotron energy parameter of the theory. Use of the guiding center model in conjunction with NPA scans across the plasma aid in estimates of ion density and E field variation with plasma radius. Author

N74-27234*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTROSCOPIC RESULTS IN HELIUM FROM THE NASA LEWIS BUMPY TORUS PLASMA
Richard W. Richardson 1974 22 p refs Presented at 1st Intern. Conf. on Plasma Sci., Knoxville, Tenn., 15-17 May 1974; sponsored by IEEE
(NASA-TM-X-71569; E-8006) Avail: NTIS HC $3.00 CSCL 20I

Spectroscopic measurements were carried out on the NASA Lewis Bumpy Torus experiment in which a steady state ion heating method based on the modified Penning discharge is applied in a bumpy torus confinement geometry. Electron temperatures in pure helium are measured from the ratio of spectral line intensities. Measured electron temperatures range from 10 to 100 eV. Relative electron densities are also measured over the range of operating conditions. Radial profiles of temperature and relative density are measured in the two basic modes of operation of the device called the low and high pressure modes. The electron temperatures are used to estimate particle confinement times based on a steady state particle balance. Author

N74-27235# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
APPROXIMATE CALCULATION OF IONIZATION AND RECOMBINATION RATES OF HYDROGENIC PLASMAS UNDER CONSIDERATION OF THE REABSORPTION OF RESONANCE RADIATION
Siegfried Kelm Jul. 1973 42 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-114) Avail: NTIS HC $5.25; DFVLR, Porz, West Ger. 16, 50 DM

The ionization and recombination rates of plasmas consisting of hydrogen atoms and ions or hydrogenic ions were calculated by means of a special approximate method. Comparison with the exact calculations shows that the rates calculated approximately are sufficiently accurate. The influence of the reabsorption of resonance radiation and the radial diffusion of excited particles of the upper resonance level were investigated in detail for a cylindrical plasma column. Author (ESRO)

N74-27236# Owens-Illinois, Inc., Toledo, Ohio.
HIGH RESOLUTION PLASMA DISPLAY TUBE Final Report, 13 Mar. 1972 - 13 Mar. 1973
H. Joseph Hoehn, Richard A. Martel, Robert W. Burke, and John W. Miller Jan. 1974 61 p
(Contract F30602-72-C-0215; AF Proj. 5597)
(AD-776807; RADC-TR-73-402) Avail: NTIS CSCL 09/5

A program to determine the practicality of fabricating and driving plasma display tubes possessing 1024x1024 (1,048,576) individually addressable elements has been completed. Primary emphasis was given to a study of the processing trade-offs between panel designs of different sizes with line densities from 60 to 100 lines per inch. Analysis of relative difficulties associated with the fabrication of larger panels versus the maintenance of

tighter dimensional tolerances required to achieve successful electro/optical operation at higher resolution led to a choice of 83 lines per inch (lines on 12 mil centers) as the most suitable compromise. Processes to produce plasma display tubes with 1024x1024 lines in an active area of 12 1/4 x 12 1/4 inches were developed. Several panels of this size were fabricated and evaluated. (Modified author abstract) GRA

N74-27237# Naval Research Lab., Washington, D.C.
THE COHERENT PRODUCTION OF ENERGETIC ELECTRONS IN ANOMALOUS REFLECTION AND ABSORPTION OF INTENSE LASER LIGHT
Wallace M. Manheimer and H. H. Klein Mar. 1974 24 p refs
(NRL Proj. H02-34)
(AD-777723; NRL-MR-2758) Avail: NTIS CSCL 20/9

The rate at which electrons are transported from the body to the nonthermal tail of the distribution function in the nonlinear stage of reflective and absorptive parametric instabilities is computed. The calculation is done by conserving energy and momentum between waves and particles in the nonlinear regime. For the case of reflection, the reflection coefficient and energy flux of nonthermal particles are computed. For absorption, the rate of production of energetic particles is found. Also, the transport of energetic particles into the core of a laser fusion plasma is examined. Author (GRA)

N74-27238# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTABILITY OF THE ANODE LAYER IN A LOW-PRESSURE DISCHARGE IN A TRANSVERSE MAGNETIC FIELD
E. I. Barkhudarov and N. A. Kervalishvili 4 Apr. 1974 12 p refs Transl. into ENGLISH from the book "Plazmennye Uskoriteli" USSR, 1973 p 61-65
(FTD Proj. T74-04-03)
(AD-777296; FTD-HT-23-1048-74) Avail: NTIS CSCL 20/9

The dynamic characteristics of electrons with anomalously high energy were studied. Results show that the current of electron to the cathode along the magnetic field is accompanied by periodically successive ejections of electrons. Results are given which describe the processes in the anode layer of a discharge and their connection with ejection of electrons to the cathode. A.A.D.

N74-27239# Wright State Univ., Dayton, Ohio. Dept. of Physics.
DIAGNOSTIC METHODS AND INSTABILITY SUPPRESSION TECHNIQUES FOR A MIRROR GEOMETRY PLASMA WITH RADIAL ELECTRIC FIELDS Final Report, 1 Aug. 1969 - 30 Jun. 1973
John S. Martin Dec. 1973 150 p refs
(Contract F33615-69-C-1842; AF Proj. 7073)
(AD-777575; ARL-73-0115) Avail: NTIS CSCL 20/9

Theoretical and experimental work on a rotating magnetoplasma in 4:1 mirror geometry is described. The properties of seven plasma sources are summarized. The main plasma source, consisting of a helical Lisitano coil and spiral thermionic filament to create a parabolic potential profile, produced a plasma having the following parameters at the center point: density 1E17 to 5E18/cu meter, electron temperature 1.5E4 to 3E4 K, ion temperature 3E3 to 2E4 K, magnetic induction 0.02 to 0.04T, radial electric field up to 100 V.m in a neutral argon pressure of 1.8 mtorr. A rapid method for determining time-resolved plasma parameters using Langmuir probes, boxcar integrator, memory display unit and minicomputer is described. A theory of collisional drift waves for a partially ionized magnetoplasma with ion temperature not equal to electron temperature is described. (Modified author abstract) GRA

N74-27240# Naval Research Lab., Washington, D.C.
THE EFFECT OF TRAPPING ON THE SATURATION OF THE RAMAN BACKSCATTER INSTABILITY
H. H. Klein, Edward Ott, and Wallace Manheimer Mar. 1974 10 p refs
(AD-777677; NRL-MR-2757) Avail: NTIS CSCL 20/9

The criterion for whether the Raman backscatter instability saturates by electron trapping or by pump depletion is determined and tested by computer simulation. Author (GRA)

N74-27241# Naval Research Lab., Washington, D.C.
NON-LINEAR STABILIZATION OF BEAM PLASMA INSTABILITIES
Konstantinos Papadopoulos Mar. 1974 35 p refs
(AD-777716; NRL-MR-2749) Avail: NTIS CSCL 20/9

The effect of parametric instabilities induced by waves produced in the kinetic stage of beam-plasma interactions is investigated. It is found that within a definite range of plasma parameters the oscillating two stream instability (O.T.S.) is capable of stabilizing the beam plasma instability at a level substantially lower than the one predicted by quasi-linear theory. This occurs because at a certain level of beam generated waves the transfer of wave energy outside the spectral region in resonance with the beam by the O.T.S. is faster than the instability growth. The consequences of this non-linear stabilization with respect to the efficiency of plasma heating in the laboratory and with respect to phenomena observed in the auroras and the type III radiobursts are presented. Author (GRA)

N74-27242# Naval Research Lab., Washington, D.C.
DEPARTURE FROM LTE (LOCAL THERMODYNAMIC EQUILIBRIUM) IN AN OXYGEN PLASMA. 2: COLLISIONAL-RADIATIVE MODEL Interim Report
P. S. Julienne, J. Davis, and E. Hyman Mar. 1974 36 p refs
(DNA Proj. NWED-QAXH)
(AD-777721; NRL-MR-2740-2) Avail: NTIS CSCL 20/9

A collisional-radiative model of a decaying oxygen plasma is constructed in order to characterize the visible and infrared emission as a function of electron density and temperature. All collisional and radiative processes affecting the population of the O(I)(quartet S)nl levels up to principal quantum number 18 are included in the model. Some results are given. (Modified author abstract) GRA

N74-27243# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
TRANSPORT PHENOMENA IN HIGHLY IONIZED SHOCK-HEATED GASES Final Report, Apr. 1969 - Dec. 1973
Robert M. Nerem 28 Feb. 1974 14 p refs
(Grant AF-AFOSR-1759-69; AF Proj. 9783; OSURF Proj. 2785)
(AD-777300; AFOSR-74-0467TR) Avail: NTIS CSCL 20/9

The propagation and structure of strong shock waves in xenon have been studied under conditions where radiative transfer effects are important. Experiments carried out have included measurements of incident shock wave velocity, time-resolved spectra, broadband post-shock visible radiation, and post-incident and reflected shock wave temperature time history. These experiments have been supported by theoretical thermodynamic, radiative, and shock structure calculations. Author (GRA)

N74-27244# Aerospace Corp., El Segundo, Calif.
RESONANT ALFVEN WAVES IN A DIPOLE MAGNETIC FIELD Technical Report, Aug. - Dec. 1973
Y. T. Chiu 19 Mar. 1974 34 p refs
(Contract F04701-73-C-0074)
(AD-777168; TR-0074(4260-10)-9; SAMSO-TR-74-61) Avail: NTIS CSCL 20/9

The general problem of determining the plasma density distribution in a dipole magnetic field by means of the characteristics of resonant Alfven waves is discussed in terms of the theory of Hill's differential equation. It is shown that for a spectrum of power-law plasma density models the vector wave equation for resonant Alfven waves, guided along field lines of a static dipole magnetic field, can be solved exactly in terms of Mathieu functions. Author (GRA)

N74-27245# Naval Research Lab., Washington, D.C.
A CONTINUOUSLY REZONABLE FLUID SOLVER IN MOVING ORTHOGONAL COORDINATES WITH TIME DEPENDENT METRIC
D. V. Anderson Apr. 1974 32 p refs
(NRL Proj. H02-27A; DNA Proj. HC-017)
(AD-777686; NRL-MR-2769) Avail: NTIS CSCL 20/9

A transformation algorithm SLIDE is developed to solve fluid equations in most orthogonal coordinate systems. A very useful and unique feature of the algorithm allows the metric of the orthogonal system to be a function of time. Quasi-Lagrangian

grids may then be employed to follow contours of some fluid quantity. One set of grid lines follow the contours and the other sets are constructed orthogonal. As the contours move during the evolution of the problem the metric changes as a function of time. The SLIDE algorithm is then used to solve the fluid equations in this moving coordinate system. Unlike most rezoned algorithms were considerable numerical diffusion is introduced, here the numerical diffusion is actually reduced by the rezoning process. Author (GRA)

N74-27246# Mathematical Sciences Northwest, Inc., Seattle, Wash.
LASER HEATING OF MAGNETICALLY CONFINED PLASMAS FOR X-RAY PRODUCTION Final Report, 10 Apr. 1972 - 30 Apr. 1973
Alan L. Hoffman Nov. 1973 162 p refs
(Contract DNA001-72-C-0218)
(AD-777072; MSNW-73-106-1; DNA-3251F) Avail: NTIS CSCL 20/9

Axial heating of a high density, initially low beta, theta-pinch plasma by 10.6 micrometer radiation has been demonstrated. A self laser beam trapping, electron density minimum on-axis has been created and maintained by magnetic field shaping and laser heating. A 10-cm long by 6-mm diameter 5 x 10 to the 17th power/cc electron density plasma column has been heated from an initial temperature of 10 eV to 100 eV by 50 J of laser energy in 100 nsec. The resulting plasma expansion and on-axis density reduction has been measured by holographic interferometry. (Modified author abstract) GRA

N74-27247# Naval Intelligence Support Center, Washington, D.C. Translation Div.
INDUCTION MAGNETOHYDRODYNAMIC MHD GENERATOR WITH A CAVITY-TYPE NUCLEAR REACTOR
V. A. Dmitrievskii and L. A. Zaklyazminskii Dec. 1973 14 p refs Transl. into ENGLISH from Teplofiz. Vys. Temp. (USSR), v. 9, no. 2, Mar./Apr. 1971 p 405-412
(AD-777444; NISC-Trans-3489) Avail: NTIS CSCL 10/2

A design for an induction magnetohydrodynamic generator (MHD) with a cavity-type nuclear reactor is discussed. GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-27248 Texas A&M Univ., College Station.
ELECTRICAL AND OPTICAL PROPERTIES OF ION-ACTIVATED CdS THIN FILMS Ph.D. Thesis
Tarak Nath Bhar 1973 123 p
Avail: Univ. Microfilms Order No. 74-13053

The fabrication and resulting electrical and optical properties of Bi ion-implanted CDS thin films are considered. An optimum doping density, anneal temperature and time for maximum sensitization has been determined. With an implantation dose of 10 to the 15th power ions/sq cm the light-to-dark current ratio is 50 times that of an unimplanted sample for an illumination level of 75 foot-candles. Damage which resulted due to implantation is studied with Scanning Electron Microscopy. The observed dark spots are interpreted as small interstitial clusters or unresolvable interstitial dislocation loops produced by displacement cascades from the bombarding ions. Observed superlinearity of photo-current with light intensity is supported with a theoretical calculation based on a two-state model. Theoretical calculations are made from both closed form and numerical analytical approaches. Spectral response curves are interpreted in terms of volume and surface excitation of photocarriers. Dissert. Abstr.

N74-27249 Stanford Univ., Calif.
THE EFFECT OF INTERCALATE AND LAYER PROPERTIES ON SUPERCONDUCTING TRANSITION METAL DICHALCOGENIDES Ph.D. Thesis
Stephen Frederick Meyer 1974 128 p
Avail: Univ. Microfilms Order No. 74-13660

The underlying motivation for the investigation of layered materials was to understand the interaction between the intercalate and the layered material, leading to the observed changes in the superconductivity. To further this end, new systems were studied and new methods of intercalation developed. A brief review of the studies on intercalated materials is provided along with a basic description of the crystal structures of the materials. The Acrivos theory of charge transfer stabilization of intercalation complexes is presented and compared with some experimental studies. The conventional thermal reaction method of intercalation was extended to additional systems and phases of layered materials. The compounds formed were characterized in terms of crystal structure, heat capacity, and resistivity, and compared with existing knowledge of previously studied systems. Dissert. Abstr.

N74-27250*# Tennessee Univ., Knoxville. Earth Resources and Astrophysics Lab.
FUNDAMENTAL BANDS OF S(32)O2(16)
K. Fox, G. D. T. Tejwani, and R. J. Corice, Jr. Sep. 1972 38 p refs
(Grant NGL-43-001-021)
(NASA-CR-138668; UTPA-ERAL-01) Avail: NTIS HC $5.00 CSCL 20L

The infrared-active vibration-rotation fundamentals of sulfur dioxide were measured with moderately high spectral resolution. Quantum number assignments were made for spectral lines from J = O to 57, by comparison with theoretically computed spectra which include the effects of centrifugal distortion. The following values for the band centers were determined: nu sub 1 = 1151.65 + or - 0.10/cm, nu sub 2 = 517.75 + or - 0.10/cm, and nu sub 3 = 1362.00 + or - 0.10/cm. Intensities of the observed lines have also been computed. Dipole moment derivatives were obtained. Author

N74-27251# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LOW TEMPERATURE EXPERIMENTS ON THE STIMULATION OF FnS PHOSPORS BY ELECTRIC FIELDS
P. Lenz and N. Riehl Feb. 1973 19 p refs Transl. into ENGLISH from Z. Angew. Phys. (West Germany), v. 32, no. 5-6, 1972 p 366-371
(NTC-74-11854; Rept-73-54) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library,

The stimulation of phosphors by electric fields is investigated. Differently doped ZnS powders at a temperature of 8 K under experimental conditions which preclude any emptying of shallow traps by external sources of IR is considered. As short voltage pulses (field strength about 10,000 V/cm) are applied to the sample during excitation by UV, Gudden-Pehl flashes appear. Their rise time is less than 10 to the minus 8th power sec; the unusually high amplitude corresponds to 100 to 1000 times the fluorescent intensity. The flash amplitude decreases rapidly with increasing temperature. Author

N74-27252# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LUMINESCENCE DECAY OF ZnS/Cu
R. Grasser, K. Hermanns et al Feb. 1973 8 p refs Transl. into ENGLISH from Z. Phys. (West Germany), v. 250, no. 3, 1971 p 248-253
(NTC-74-11913; Rept-73-53) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The decay characteristics of ZnS/0.0001 cu have been investigated by ion pulse excitation. The excitation density could be varied by using ions of different mass. The decay is exponential. The decay times depend on the ion pulse duration and on the penetration depth of the ions used. The green emission exhibits two different decay times. The intensity of the slower component of the green emission could be altered by excitation with UV light before decay measurement. Author

N74-27253# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE QUANTUM STATES AND THE OPTICAL TRANSITIONS OF AN ELECTRON IN A POLARON AND IN A COLOR CENTER IN A CRYSTAL
S. I. Pekar and M. F. Deigen Feb. 1973 11 p refs Transl. into ENGLISH from ZH. Eksp. Teor. Fiz. (USSR), V. 18, no. 6, 1948 p 481-486
(NTC-74-11914; Rept-73-46) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A quantitative investigation was made of the quantum states of an electron in a polaron located in an ideal ionic crystal, as well as in crystal color centers. The energy levels, psi functions, and the oscillator strengths of the optical transitions were calculated. Author

N74-27254# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON THE DISSOCIATION OF MAGNESIUM OXIDE UNDER ELECTRON BOMBARDMENT OF EFFECTIVE SECONDARY EMITTERS
A. N. Andronov and V. A. Saltymakov Jan. 1973 17 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Leningrad), no. 311, 1970 p 231-239
(NTC-74-11923; Rept-73-47) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The dissociation of complex compounds in particular, oxides of the alkali earth metals under electron bombardment were investigated in connection with the contamination of oxide cathodes during the working processes of electron tubes. The use of radioactive isotopes and mass spectrometers allowed the determination of the nature of the materials which were evolved when oxide films were bombarded by electrons. Metallic and gas like dissociation product components, present in the alkali earth metals, and the evolution rate of the dissociation products were investigated as a function of the electron bombardment regime. M.C.F.

N74-27255# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFRARED TRANSITIONS OF THE TRIVALENT ERBIUM ION IN THE CRYSTAL LATTICE OF CADMIUM FLUORIDE
M. Bancie-Grillot, E. Grillot et al Mar. 1973 6 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 275, no. 2, 1972 p 109-112
(NTC-74-11892; Rept-73-104) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The results of a study on the optical properties of CdF2Er (3+) in the visible region are presented. Both absorption and fluorescence transitions are observed between the base level I-4(15/2) and the first two excited levels I-4(13/2)and I-4(11/2). On the other hand, the absorption transition up to I-4(9/2) has a low probability and the series of emission rays towards lambda = 0.84 mu is not its inverse process, but can rather be attributed to the transition S-4(2/3) yields I-4(13/2). Author

N74-27256# Lincoln Lab., Mass. Inst. of Tech., Lexington.
BRILLOUIN SCATTERING IN ACOUSTICALLY ACTIVE CRYSTALS AS ILLUSTRATED BY BACKSCATTERING IN QUARTZ
M. Fritsche and G. Kluge Jan. 1973 13 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 28, no. 3, 1972 p 231-237
(NTC-74-11881; Rept-73-35) Avail: NTIS HC $4.00, National Translations Center, John Crerar Library, Chicago, Ill. 60616

Electromagnetic field coupled to the elastic field of an acoustically active crystal is investigated. From the resulting system of nonlinear equations, the polarization of the Brillouin scattered light is calculated approximately as a function of the polarization of the laser light. In acoustically active crystals, the scattered light for linearly polarized laser light is always circularly polarized, in contrast to acoustically inactive crystals where the scattered light is also linearly polarized. Author

N74-27257# Lincoln Lab., Mass. Inst. of Tech., Lexington.
IMPURITIES IN GERMANIUM, SILICON AND GALLIUM ARSENIDE: RECOMBINATION CHARACTERISTICS
K. D. Glinchuk May 1973 23 p refs Transl. into ENGLISH from Poluprovod. Tekh. Mikroelektron. (USSR), no. 7, 1972 p 51-60
(NTC-74-11864; Rept-73-144) Avail: NTIS HC $4.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The properties of semiconductor instruments are influenced by the recombination processes of electrons and holes. The rate of recombination of impurity centers in germanium, silicon, and gallium aresenide was investigated for the purpose of applying the results to the construction of semiconductor devices. A.A.D.

N74-27258# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE INFLUENCE OF THERMAL TREATMENT OF p-CdSnAs2
Ch. Dovletmuradov, A. Allanazarov et al Jan. 1973 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk Turkm. SSR, ser. Fiz.-Tekh., Khim. Geol. (TSSR), no. 3, 1972 p 103-106
(NTC-74-11862; Rept-73-108) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The effect of thermal treatments on the electric properties of single crystals of p-CdSnAs2 is described. The investigation of R(T) and sigma (T) of p-CdSnAs2 crystals after treatment was carried out in the temperature range from 100 to 500 C. Author

N74-27259*# Tennessee Technological Univ., Cookeville.
OVONIC SWITCHING IN TIN SELENIDE THIN FILMS Ph.D. Thesis
Charles Ronald Baxter Jun. 1974 113 p refs
(Grant NGR-43-003-012)
(NASA-CR-138617) Avail: NTIS HC $8.75 CSCL 20L

Amorphous tin selenide thin films which possess Ovonic switching properties were fabricated using vacuum deposition techniques. Results obtained indicate that memory type Ovonic switching does occur in these films the energy density required for switching from a high impedance to a low impedance state is dependent on the spacing between the electrodes of the device. The switching is also function of the magnitude of the applied voltage pulse. A completely automated computer controlled testing procedure was developed which allows precise control over the shape of the applied voltage switching pulse. A survey of previous experimental and theoretical work in the area of Ovonic switching is also presented. Author

N74-27260# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
GRAIN BOUNDARY MOBILITY IN ANION DOPED MgO
Cawas M. Kapadia and Martin H. Leipold [1974] 55 p refs Avail: NTIS HC $5.75

The anions OH(-), F(-) and Cl(-) are shown to enhance grain growth in MgO. The magnitude of their effect decreases in the order in which the anions are listed and depends on their location (solid-solution, second phase) in the MgO lattice. Most anions exhibit relatively high vapor pressures at sintering temperatures, retard densification, and invariably promote residual porosity. The role of anions on grain growth rates was studied in relation to their effect on pore mobility and pore removal. The atomic process controlling the actual rates was determined from observed kinetics in conjunction with the microstructural features. The effects of all anions are not the same with respect to controlling mechanisms. OH(-) and F(-) control behavior through creation of a defect structure and a grain boundary liquid phase, while Cl(-) promotes matter transport within pores by evaporation-condensation. Studies on the additional anions S(2-) gave results which were no different from undoped MgO, because of evaporative losses during hot pressing. The effect of sulphur is negligible or undetermined. Author

N74-27261*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VAPOR PHASE GROWTH OF GROUPS III-V COMPOUNDS BY HYDROGEN CHLORIDE TRANSPORT OF THE ELEMENTS Patent Application
Ramesh C. Tyagi (NAS-NRC), William J. Debnam, Jr., Maxwell F. McNear, Roger K. Crouch, and Roger A. Breckenridge, inventors (to NASA) Issued 19 Dec. 1973 15 p
(NASA-Case-LAR-11144-1; US-Patent-Appl-SN-426405) Avail: NTIS HC $4.00 CSCL 20L

An apparatus for forming binary, ternary, and quarternary compounds derived from elements of Groups III - V was developed. The apparatus employs a fuzed quartz growth tube coated with carbon to prevent impurities from being diffused into the crystal being grown. The tube is purged and cleaned after crystal growth by passing hydrogen chloride gas through it. By changing the carrier gas flow rates over various elements, the crystal composition can be graded and controlled to almost any desired product. The preparation of gallium arsenide crystals with good single crystal qualities of the epitaxial layer is described. NASA

N74-27262# Sandia Labs., Albuquerque, N.Mex.
EFFECT OF BERYLLIUM ADDITIONS ON THE MICRO-

STRUCTURE AND TYPE OF FAILURE OF Al-Mg ALLOYS
V. K. Afanasev and E. A. Dmitrievtseva Sep. 1973 8 p refs
Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; 15: no. 5 (USSR), 1972 p 121-123 Sponsored by AEC
(SLA-73-6001) Avail: NTIS HC $3.00

The effect of small quantities of beryllium on the microstructure, type of failure, microhardness, tensile strength, stability, and plasticity of Al-Mg alloys containing from 1 to 13% Mg is studied. Metallographic studies were made of samples in the cast, tempered, annealed, and aged states. Microsections were examined in light and dark fields with magnification of 110 and 260 times. NSA

N74-27263# Naval Ordnance Lab., White Oak, Md.
MULTIPHOTON TRANSITIONS IN HELIUM BETWEEN 1S AND 2S LEVELS
Hermenzo D. Jones 27 Feb. 1974 20 p refs
(AD-777042; NOLTR-74-4) Avail: NTIS CSCL 07/4

An extension of the momentum-translation approximation to include many-electron systems is presented. The multiphoton 1S-2S transition amplitude for a helium atom in the presence of combined intense and weak electromagnetic fields is calculated. Nonperturbative behavior of the results is exhibited at high intensities. Author (GRA)

N74-27264# Illinois Univ., Urbana. Coordinated Science Lab.
SURFACE SELF-DIFFUSION ON AN FCC CRYSTAL: AN ATOMIC VIEW
Guy Ayrault and Gert Ehrlich Nov. 1973 61 p refs
(Contract DAAB07-72-C-0259; Grant NSF GH-31998)
(AD-775636; R-632; VILU-ENG-73-2235) Avail: NTIS CSCL 11/6

Migration of individual atoms self-adsorbed on different low-index planes of a face-centered cubic metal has been studied for the first time. Diffusion coefficients and activation energies for the motion of rhodium on perfect planes of the rhodium lattice in the absence of high fields, have been derived from direct observation of atomic positions, using a field ion microscope. Correlation effects, due to interactions with other rhodium atoms, are observed even at interatomic distances greater than 7.5A. All diffusion parameters have therefore been derived from experiments with only a single atom on a plane. The results are at variance with previous measurements on similarly structured planes of tungsten; however, further observations of single atoms are needed to establish the exact role of surface structure. (Modified author abstract) GRA

N74-27265# Harry Diamond Labs., Washington, D.C.
RARE EARTH ION HOST LATTICE INTERACTIONS. 1: POINT CHARGE LATTICE SUM IN SCHEELITES
Nick Karayianis and C. A. Morrison Oct. 1973 67 p refs
(DA Proj. 1T0-61102-A-31C; HDL Proj. 306300)
(AD-776330; HDL-TR-1648) Avail: NTIS CSCL 20/2

The procedure for performing a point charge lattice sum in scheelite-type crystals (including zircon structure crystals) is discussed, and convergence of the sums for various A(nm) is investigated. It is concluded that including charges only within a given radius (spherical sums) gives faster convergence than rectangular sums. Spheres of radii 25A and 70A are sufficient for A(nm) with $n > or = 3$ and $n = 2$, respectively. A listing of a FORTRAN computer program that performs the spherical sums is given, and the results for several scheelite and zircon structure crystals are given, in tables iiia and iiib. Explicit expressions for associated Legendre polynomials, P(nm), for $n < or = 9$ are also included for reference. Author (GRA)

N74-27266# Army Foreign Science and Technology Center, Charlottesville, Va.
PROBLEM OF METALLIC HYDROGEN
Isaac Khalatnikov 27 Dec. 1973 9 p Transl. into ENGLISH from Priroda (USSR), no. 10, 1971 p 8-11
(AD-776570; FSTC-HT-23-2494-72) Avail: NTIS CSCL 07/4

The report concerns experimental programs investigating metallic hydrogen. Methods of producing metallic hydrogen are described. GRA

N74-27267# Utah Univ., Salt Lake City. Dept. of Physics.
RE-INTERPRETATION OF THE Ti(3+) INTERSTITIAL ESR SPECTRUM IN RUTILE
L. N. Shen, O. W. Johnson, W. D. Ohlsen, and John W. DeFord 14 Mar. 1974 12 p refs
(Grant DAHC15-73-G-0002)
(AD-776758) Avail: NTIS CSCL 20/12

A variety of rutile samples were heat treated in atmospheres of H2, H2O, and O2 according to prescriptions which theoretically and experimentally either favor or suppress H interstitial formation. The H concentration and conduction electron concentrations in the samples were monitored optically. The A spectrum, which has been universally accepted as being due to Ti(3+) interstitials, is found instead to be associated with H. Author (GRA)

N74-27268# Stanford Univ., Calif. Microwave Lab.
STUDY OF NONLINEAR ACOUSTICS FOR THE PURPOSE OF PROCESSING SOPHISTICATED SIGNALS Final Report, 30 Nov. 1970 - 29 Nov. 1973
C. F. Quate Feb. 1974 56 p refs
(Contract DAHC04-71-C-0005)
(AD-776994; SU-ML-2263; AROD-9358-7-E) Avail: NTIS CSCL 20/12

The nonlinear interaction between two surface acoustic waves can be used in a number of signal processing devices. In this report the principles which underlie this interaction are developed both theoretically and experimentally. In the signal processing devices it is demonstrated that both convolution and Fourier transformations can be carried out in real time. In the imaging work it is shown that acoustic surface waves can be used to scan optical images which are projected onto a semiconducting layer of silicon. This scanning process transfers spatial image pattern into a temporal pattern which can be transmitted electrically to a remote display station. (Modified author abstract) GRA

N74-27269# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
STUDY OF BASIC PROCESSES IN RADIATION DAMAGE Final Report, 1 Apr. 1971 - 30 Nov. 1973
R. E. McDonald 15 Apr. 1974 50 p refs
(Contract N00014-71-C-0290)
(AD-777728; LMSC-D401278) Avail: NTIS CSCL 20/12

Polarized radioactive nuclei are produced and implanted in metallic and semiconductor hosts. Resonance depolarization reveals the interaction between host and implant, giving information on radiation damage, implant site location, and motion via structure in the resonance line shape. Author (GRA)

N74-27270# Boeing Aerospace Co., Seattle, Wash.
NONLINEAR PHENOMENA IN SEMICONDUCTORS THROUGH MULTI-PHOTON ABSORPTION Final Report, 1 Apr. 1971 - 31 Dec. 1973
Wen S. Chen and Pin-Wei Chen Feb. 1974 34 p refs
(Contract F44620-71-C-0055; AF Proj. 9763)
(AD-777217; D180-15000-3; AFOSR-74-0354TR) Avail: NTIS CSCL 20/12

The research is a systematic study of both the experimental and theoretical aspects of the several nonlinear phenomena produced by CO2 laser irradiation of the narrow gap semiconductor InSb. The two-proton excitation rate at 2K and 77K is measured and calculated; the agreement between experiment and theory is within the experimental accuracy. The electron-hole recombination coefficient is also measured and calculated, and a one to two order-of-magnitude discrepancy between the values is found. The investigation of this discrepancy has led to the discovery of a promising method for obtaining more precise information than yet available about the shape of the warped valence band in InSb. The properties of the excess carriers resulting from the two-photon excitation of electron-hole pairs are reported in detail. These properties include photoconductivity, infrared absorption, recombination radiation, stimulated emission, hot electron effect, Hall mobility and uniformity of carrier density along the irradiating beam. A new phenomenon is described: pulse shaping of relatively high-intensity laser beams as they traverse the InSb crystal. This effect is explained in detail by nonlinear free-hole absorption. Author (GRA)

N74-27271# California Univ., Berkeley. Dept. of Physics.
JOSEPHSON JUNCTIONS AS MICROWAVE HETERODYNE DETECTORS Ph.D. Thesis
Yuan Taur Mar. 1974 138 p refs
(Contract N00014-69-A-0200-1056)
(AD-777663) Avail: NTIS CSCL 17/5

The properties of point contact Josephson junctions operated as 36 GHz heterodyne detectors have been extensively studied. The measured performance is in good agreement with the theory developed for microwave coupling, conversion efficiency, and intrinsic noise based on the Resistively Shunted Junction model. A tunable cavity matching structure was designed to obtain good RF coupling to the point contact. By operating vanadium junctions at 1.4 K, a single side band mixer noise temperature of 54 K (referred to the input) with a conversion gain of 1.35 and a signal bandwidth of the order of 1 GHz is achieved. This is significantly better than existing resistive mixers in this frequency range. Harmonic mixing, mixing in the presence of relaxation oscillation, and self local oscillator mixing with Josephson junctions is also tried, but the results are not as promising as fundamental mixing with an external local oscillator. Finally, two additional topics are discussed: a Josephson effect homodyne detector, and a proposed design for superconducting bolometers making use of the recently developed superconducting quantum interference devices. Author (GRA)

N74-27272# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
INFRARED SENSITIVE TRAP DISTRIBUTION IN SEMICONDUCTORS
Inder Jit Singh Dec. 1973 144 p refs
(Contract F33615-71-C-1859; AF Proj. 7885)
(AD-777153; ARL-73-0191) Avail: NTIS CSCL 20/12

A system to observe infrared (IR) stimulation spectra of IR sensitive phosphors was developed and assembled. Powder phosphors applied in the form of a coating on sapphire discs and zinc sulfide single crystals, were tested for response to infrared of wavelengths from 0.7 micrometers to 10 micrometers. The samples under test could be cooled to liquid helium temperature (4.2 K). Special techniques were developed to observe very weak infrared stimulated luminescence in the presence of strong background phosphorescence. In zinc sulfide: copper: lead phosphors at 77 K, traps were detected at 1.1 electron volts and 0.84 electron volts from a band edge. Measured infrared absorption cross sections of 0.87 x 10 super minus 17 centimeter squared and 4.0 x 10 super minus 17 centimeter squared were of the same order of magnitude as calculated values of 5.9 x 10 super minus 17 centimeter squared and 4.5 x 10 super minus 17 centimeter squared respectively. (Modified author abstract) GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-27273*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURANT REQUIREMENTS FOR DISCHARGE OF LIQUID METHANE FROM A 1.52-METER-(5-FT-) DIAMETER SPHERICAL TANK UNDER BOTH STATIC AND SLOSH CONDITIONS
Richard L. DeWitt and Thomas O. McIntire Washington May 1974 106 p refs
(NASA-TN-D-7638; E-7687) Avail: NTIS HC $4.50 CSCL 21I

Pressurized expulsion tests were conducted to determine the effect of various physical parameters on the pressurant gas (methane, helium, hydrogen, and nitrogen) requirements during the expulsion of liquid methane from a 1.52-meter-(5-ft-) diameter spherical tank and to compare results with those predicted by an analytical program. Also studied were the effects on methane, helium, and hydrogen pressurant requirements of various slosh excitation frequencies and amplitudes, both with and without slosh suppressing baffles in the tank. The experimental results when using gaseous methane, helium, and hydrogen show that the predictions of the analytical program agreed well with the actual pressurant requirements for static tank expulsions. The analytical program could not be used for gaseous nitrogen expulsions because of the large quantities of nitrogen which can dissolve in liquid methane. Under slosh conditions, a pronounced increase in gaseous methane requirements was observed relative to results obtained for the static tank expulsions. Slight decreases in the helium and hydrogen requirements were noted under similar test conditions. Author

N74-27274# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF SOLID PROPELLANT COMBUSTION IN STANDARD AND HIGH ACCELERATION ENVIRONMENTS Final Report, 1 Jul. 1972 - 1 Jan. 1974
M. Abraham, III, O. A. Klahr, R. R. Gerhardt, and D. W. Netzer Mar. 1974 56 p refs
(AD-777727; NPS-57NT74031) Avail: NTIS CSCL 21/9

Nonmetallized double-base and composite propellant, metallized composite propellant, and ammonium perchlorate AP/binder sandwich combustion were studied in standard and high acceleration environments. Experimental techniques used were high speed motion pictures, two-color schlieren, laser schlieren, and centrifuge mounted combustion bombs. It was found, for double-base propellant, that the temperature increased continuously from the surface into the visible flame. Acceleration induced buring rate augmentation occurred and resulted in elimination of the visible flame. The AP/binder sandwich combustion was also found to be acceleration sensitive with binder flow-AP interactions proposed as the mechanism. Composite propellants burned with local diffusion flames to pressures as low as 100 psi. A comparison is made between AP/binder sandwich combustion and propellant combustion. (Modified author abstract) GRA

N74-27275# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
MEASUREMENT OF STEADY STATE AND TRANSIENT SOLID PROPELLANT BURNING RATES WITH MICROWAVES Final Report
Alexandros C. Alkidas, Albert T. Clary, Garland Giles, and Samuel V. Shelton Dec. 1973 127 p refs
(Grant AF-AFOSR-1934-70; AF Proj. 9711)
(AD-777283; AFOSR-74-0458TR) Avail: NTIS CSCL 21/9

A microwave continuous measurement technique has been utilized to measure burning rates of a CTPB and AP composite solid propellant during steady state and rapid decompression. A microwave signal oscillating at a known source frequency is passed through the end of a burning propellant strand opposite the burning surface and allowed to reflect off the burning surface which is receding at some unknown velocity. By continuously comparing the phase angle of this reflected signal with the phase angle of another signal oscillating at the original source frequency, a relative phase angle between the two signals is obtained. The rate of change of this relative phase angle with time is proportional to the propellant's burning rate. Accurate (plus or minus 10 percent) continuous burning rate data was obtained and shown to be within capabilities of the system for dP/dt values less than about 2500 psi/second. (Modified author abstract) GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-27276*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID ROCKET VALVE COMPONENTS NASA Space Vehicle Design Criteria (Chemical Propulsion)
Washington Aug. 1973 150 p refs
(NASA-SP-8094) Avail: NTIS HC $5.00 CSCL 13K

A monograph on valves for use with liquid rocket propellant engines is presented. The configurations of the various types of valves are described and illustrated. Design criteria and recommended practices for the various valves are explained. Tables of data are included to show the chief features of valve components in use on operational vehicles. Author

N74-27277*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-SPEED WIND TUNNEL TESTS OF A 50.8-CENTIMETER (20-IN.) 1.15-PRESSURE-RATIO FAN ENGINE MODEL
Howard L. Wesoky, John M. Abbott, James A. Albers, and Donald A. Dietrich Washington Jun. 1974 46 p refs
(NASA-TM-X-3062; E-7844) Avail: NTIS HC $3.25 CSCL 21E

At a typical STOL aircraft takeoff and landing velocity, wind tunnel aerodynamic and acoustic measurements demonstrated that an inlet lip-area contraction ratio of 1.35 was superior to a ratio of 1.26 at high incidence angles. A 17 percent reduction in net thrust and an increase of 9 decibels in sound pressure level at the blade passing frequency resulted from inlet flow separation at an incidence angle of 50 deg with the 1.26-contraction-ratio inlet. Reverse-thrust forces obtained with blade rotation through the feathered angle were 1.8 times larger than with blade rotation through the flat angle. Reverse-thrust force was reduced from 30 to 50 percent and sound pressure level increased from 3 to 7 decibels at the blade passing frequency between the wind-tunnel-off condition and a typical STOL aircraft landing velocity. Author

N74-27278*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE FOR ORDNANCE TURBOJET ENGINE. 2: COLD-AIR PERFORMANCE WITH OPENED STATOR
Milton G. Kofskey, William J. Nusbaum, and Jeffrey E. Haas Washington Jun. 1974 24 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-7626; E-7776) Avail: NTIS HC $3.00 CSCL 21E

A single-stage axial-flow turbine was investigated to determine the effect of increased stator throat area on the performance level of a turbojet engine turbine. The stator blades were bent to increase the throat area in order to move the compressor operating point in the engine farther away from surge. Results are compared with those obtained with the as-cast stator setting. Author

N74-27279# Joint Publications Research Service, Arlington, Va.
GAS TURBINES TODAY AND TOMORROW
V. Uvarov 17 May 1974 25 p refs Transl. into ENGLISH from Nauka Zhizn (Moscow), no. 3, 1974 p 78-87
(JPRS-62029) Avail: NTIS HC $4.25

A history of the development of gas turbine engines in the Soviet Union is presented. Applications of gas turbine engines are described and illustrations are provided. Illustrations of gas turbine engine components are included. Problems encountered in the design and development of gas turbine engines are examined. Author

N74-27280# AiResearch Mfg. Co., Phoenix, Ariz.
ADAPTABILITY OF THE CLOSED BRAYTON GAS TURBINE TO UTILITY POWER PLANTS Engineering Report
28 Dec. 1973 42 p
(Rept-73-310448) Avail: NTIS HC $5.25 CSCL 21E

The utilization of fossil fuels in the closed Brayton cycle engine as applied to large scale utility power plants is described in terms of ecological advantages, operating efficiency, capabilities, and practicality. A plant layout and diagrams of the gas turbine equipment are shown. Heat source concepts, nuclear systems, and heat sink concepts are discussed. Computer analysis programs for the closed Brayton cycle and contractor information are included. A.A.D.

N74-27281 Detroit Diesel Allison, Indianapolis, Ind. Jet Propulsion Center.
AEROELASTICITY IN TURBOMACHINES
S. Fleeter, ed. 1 Jun. 1972 344 p refs Workshop held at Indianapolis, 1-2 Jun. 1972
(Contract N00014-67-A-0226-0005; Proj. Squid)
Avail: NTIS HC $20.25

The proceedings of a conference on the effects of aeroelasticity on the performance of turbine engines are presented. The limitations imposed by aeroelasticity on the strength, reliability, efficiency, and weight of turbomachines are analyzed. Some of the subjects considered are: (1) aerodynamic coefficients needed for aeroelastic calculations, (2) unsteady cascade aerodynamics including compressibility effects, (3) semi-empirical analysis of stall flutter, and (4) determination of turbine blade damage from noise spectrum measurements. For individual titles, see N74-27282 through N74-27293.

N74-27282* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERSPECTIVES IN AEROELASTICITY c01
I. E. Garrick *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 1-74 refs Presented at 14th Israel Ann. Conf. on Aviation and Astronautics, Tel Aviv, Israel, 1-2 Mar. 1972 Submitted for publication (For availability see N74-27281 16-28)

Achievements of the past decade, the state of the art, and trends in aeroelasticity are discussed. Topics selected for this end include: (1) brief orientation into the history of the subject, (2) roles of active controls and the concept of aerodynamic energy in load alleviation and in flutter suppression, (3) computerized aeroelastic analysis, (4) aeroelastic effects in stability, (5) aeroelastic optimization, (6) the use of composites, (7) recent applications of lifting surface theory to interfering surfaces and control surfaces, (8) transonic flow considerations, and (9) some problems related to the space shuttle. Author

N74-27283 Detroit Diesel Allison, Indianapolis, Ind.
ON THE UNSTALLED SUBSONIC, SONIC, AND SUPERSONIC AERODYNAMIC COEFFICIENTS NECESSARY FOR AEROELASTIC CALCULATIONS
Sanford Fleeter *In its* Aeroelasticity in Turbomachines 1 Jun. 1972 p 75-100 refs (For availability see N74-27281 16-28)

Self-excited blade vibrations in fans and compressors encountered in the development of an advanced gas turbine engine are discussed. The tendency toward higher tip speeds in modern engines has resulted in high subsonic, sonic, and supersonic flows in a significant proportion of the total fan and compressor assembly. Hence, the analysis of high subsonic, sonic, and supersonic bladings has become increasingly important. The fundamental aerodynamic problem related to self-excited blade vibrations is to determine the unsteady forces and moments which act on a reference airfoil in a cascade due to both bending and torsional vibrations. With these results, the conditions under which self-excited vibrations (flutter) of the cascade will occur can then be predicted. The mathematical model discussed is a single unified approach for the prediction of these unsteady forces and moments in a subsonic, sonic, or supersonic flow field. Author

N74-27284 Detroit Diesel Allison, Indianapolis, Ind.
UNSTEADY CASCADE FLOW: A SCHLIEREN STUDY c12
R. B. McClure *In its* Aeroelasticity in Turbomachines 1 Jun. 1972 p 101-109 (For availability see N74-27281 16-28)

Wind tunnel tests were conducted to determine the characteristics of unsteady cascade flow. Schlieren photography was used to record the flow patterns. It was determined that there is a large unsteady lift force in the low supersonic range which decreases and levels off at Mach numbers on the order of 1.3. At higher Mach numbers the magnitude of the lift increases. Once through the transonic regime, the turbine blade does not flutter until relatively high supersonic Mach numbers are reached. Author

N74-27285 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY FORCES ACTING ON TURBOMACHINE BLADES
Robert G. Legendre *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 110-139 refs (For availability

see N74-27281 16-28)

Methods for conducting numerical analyses of the blade vibrations in turbomachinery due to unsteady air flow are considered. The causes of unsteady airflow in turbomachinery are analyzed. The characteristics of conventional flutter in a potential flow are examined. The flow conditions which are considered are two dimensional flow in an incompressible fluid and simple compressibility effects in two or three dimensional flow. Some of the more complex effects of compressibility are reported. Author

N74-27286 General Electric Co., Schenectady, N.Y.
UNSTEADY CASCADE AERODYNAMICS INCLUDING COMPRESSIBILITY EFFECTS c12
R. Mani *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 140-150 refs (For availability see N74-27281 16-28)

Linearized, subsonic (compressible), unsteady aerodynamics associated with a flat plate cascade of arbitrary spacing/chord ratio and stagger angle, are discussed. A uniform subsonic flow at Mach number M exists through the flat plate cascade about which the linearization is carried out. The objective is to determine unsteady blade forces and moments due to discrete frequency disturbances with specific interblade phase angle. The disturbances could be due to: (1) potential flow field of an adjacent blade row translating past the row of interest, (2) viscous wakes shed from a translating upstream blade row, (3) sinusoidal gusts representative of inflow distortion or inflow turbulence, and (4) specified self motion of blades, in torsion or bending. Author

N74-27287 Cambridge Univ. (England).
TORSIONAL FLUTTER OF UNSTALLED BLADES AT HIGH SUBSONIC MACH NUMBERS
D. S. Whitehead *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 151-163 (For availability see N74-27281 16-28)

A numerical analysis of torsional vibration induced in unstalled blades of turbomachinery at high subsonic Mach numbers is presented. Mathematical models are developed to show the relationships between the pressure and the velocity perturbation in the flow field. It was determined that the effect of compressibility on unstalled torsional flutter is substantial and the use of incompressible theory for design calculations. The design of turbine machine blades to have a frequency parameter greater than about 1.5 to avoid flutter. Author

N74-27288 Pratt and Whitney Aircraft, East Hartford, Conn.
SUPERSONIC UNSTALLED TORSIONAL FLUTTER c01
L. E. Snyder *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 164-195 refs (For availability see N74-27281 16-28)

Aspects of supersonic unstalled torsional flutter are discussed. These aspects are: (1) the observed aeromechanical aspects of supersonic torsional flutter in fan rotors, (2) the unsteady supersonic cascade analysis which has been developed with some analytical results and (3) some recent supersonic cascade flutter tests which have been conducted. An understanding of each of these three areas is important in understanding the mechanism of supersonic unstalled torsional flutter. Author

N74-27289 Naval Postgraduate School, Monterey, Calif.
UNSTEADY TRANSONIC AND SUPERSONIC CASCADE FLOWS c12
M. F. Platzer *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 196-214 refs (For availability see N74-27281 16-28)

The occurrence of transonic and supersonic flows in modern jet engines is discussed. The effects of complex unsteady flows in this speed regime on flutter, dynamic response, and noise propagation are examined. The following aspects of unsteady transonic and supersonic cascade flows are considered: (1) a method of characteristics study of supersonic flow past oscillating flat plate cascades, (2) an elementary analytical approach for low frequency supersonic cascade flow, (3) an integral equation approach to sonic flow past oscillating cascades, and (4) a Laplace transform approach to sonic flow past oscillating cascades. A method of characteristics approach for computer solution of the problems is described. Author

N74-27290 Stevens Inst. of Tech., Hoboken, N.J.
SEMIEMPIRICAL ANALYSIS OF STALL FLUTTER c01
F. Sisto and P. V. K. Perumal *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 215-237 refs (For availability see N74-27281 16-28)
(Contract N00014-67-A-0202-0016)

A general method has been developed for predicting the nonsteady lift and moment acting on an oscillating airfoil in the stall regime. The key separation function is supplied by correlating a series of experiments. The general nature of the separation function is known and some probable forms are shown. Mathematical models are developed to show the relationships of the parameters. Author

N74-27291 United Aircraft Corp., East Hartford, Conn.
FLUTTER OF CYLINDRICAL SHELLS EXPOSED TO A SWIRL TYPE OF FLOW c01
A. V. Srinivasan *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 238-246 (For availability see N74-27281 16-28)

The flow-induced instabilities in shell-like structures are analyzed. An approximate theory was developed to express the aerodynamic pressure on a vibrating shell. The mathematical model used in the study is presented. The model consists of a long, thin cylindrical shell rotating about its longitudinal axis with constant axial torque and/or radial loads acting on the shell. The effect of both axial and circumferential velocities occurring simultaneously is examined. The circumferential velocity required at a given axial velocity to cause flutter is determined. Author

N74-27292 Princeton Univ., N.J.
FLUTTER OF CYLINDRICAL SHELL IN A SWIRLING FLOW
J. G. Ambrose *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 247-276 refs (For availability see N74-27281 16-28)

The vibration and consequent failure of cylindrical shells in a rotating flow environment are examined for application to the problems encountered by turbomachines. The analysis is directed toward determining the precise interaction of the fluid mean velocity profiles with the structural inner cylinder properties in the models and to find the parameters relating the results found in each model. Of principal concern are the rotation speeds of the outer cylinder and the mass flow rates at which severe vibrations of the inner cylinder may occur. These pairs of critical revolutions per minute and mass flow rates define a stability boundary. Examples are presented for cylindrical shell elastic behavior, cylindrical shell flutter behavior, and shear flow in the annulus. Author

N74-27293 Yale Univ., New Haven, Conn. Mason Lab.
DETERMINATION OF TURBINE BLADE DAMAGE FROM NOISE SPECTRUM MEASUREMENTS
D. Barschdorff *In* Detroit Diesel Allison Aeroelasticity in Turbomachines 1 Jun. 1972 p 277-331 (For availability see N74-27281 16-28)

The analysis of noise and vibration measurements as a method of determining possible turbine blade damage is discussed. The basic components which contribute to the noise initiation in a turbine or compressor rotor are identified. The procedure for comparing theoretical and actual spectra is described. Compared with the amplitude spectrum of a mechanically perfect rotor stage, additional discrete spectral lines to the blade passing frequency and its harmonics indicate mechanical irregularities. Author

N74-27294*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERALIZED DYNAMIC ENGINE SIMULATION TECHNIQUES FOR THE DIGITAL COMPUTER
James Sellers and Fred Teren 1974 25 p refs Proposed for Presentation at 44th Propulsion and Energetics Meeting, Ankara, 9-13 Sep. 1974; Sponsored by AGARD
(NASA-TM-X-71552; E-7968) Avail: NTIS HC $3.00 CSCL 21E

Recently advanced simulation techniques have been developed for the digital computer and used as the basis for development

of a generalized dynamic engine simulation computer program, called DYNGEN. This computer program can analyze the steady state and dynamic performance of many kinds of aircraft gas turbine engines. Without changes to the basic program DYNGEN can analyze one- or two-spool turbofan engines. The user must supply appropriate component performance maps and design-point information. Examples are presented to illustrate the capabilities of DYNGEN in the steady state and dynamic modes of operation. The analytical techniques used in DYNGEN are briefly discussed, and its accuracy is compared with a comparable simulation using the hybrid computer. The impact of DYNGEN and similar all-digital programs on future engine simulation philosophy is also discussed. Author

N74-27295*# Pratt and Whitney Aircraft, East Hartford, Conn.
JT8D-100 TURBOFAN ENGINE, PHASE 1 Final Report
Jun. 1974 215 p
(Contract NAS3-17840)
(NASA-CR-134654; PWA-4790) Avail: NTIS HC $13.75 CSCL 21E

The JT8D turbofan engine, widely used in short and medium range transport aircraft, contributes substantially to airport community noise. The jet noise is predominant in the JT8D engine and may be reduced in a modified engine, without loss of thrust, by increasing the airflow to reduce jet velocity. A configuration study evaluated the effects of fan airflow, fan pressure ratio, and bypass ratio on noise, thrust, and fuel comsumption. The cycle selected for the modified engine was based upon an increased diameter, single-stage fan and two additional core engine compressor stages, which replace the existing two-stage fan. Modifications were also made to the low pressure turbine to provide the increased torque required by the larger diameter fan. The resultant JT8D-100 engine models have the following characteristics at take-off thrust, compared to the current JT8D engine: Airflow and bypass ratio are increased, and fan pressure ratio and engine speed are reduced. The resultant engine is also longer, larger in diameter, and heavier than the JT8D base model, but these latter changes are compensated by the increased thrust and decreased fuel comsumption of the modified engine, thus providing the capability for maintaining the performance of the current JT8D-powered aircraft. Author

N74-27296*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
ACOUSTIC TESTING OF A 1.5 PRESSURE RATIO LOW TIP SPEED FAN WITH A SERRATED ROTOR (QEP FAN B SCALE MODEL)
S. B. Kazin, J. E. Paas, and W. R. Minzner [1973] 107 p
(Contract NAS3-12430)
(NASA-CR-120846) Avail: NTIS HC $8.50 CSCL 21E

A scale model of the bypass flow region of a 1.5 pressure ratio, single stage, low tip speed fan was tested with a serrated rotor leading edge to determine its effects on noise generation. The serrated rotor was produced by cutting teeth into the leading edge of the nominal rotor blades. The effects of speed and exhaust nozzle area on the scale models noise characteristics were investigated with both the nominal rotor and serrated rotor. Acoustic results indicate the serrations reduced front quadrant PNL's at takeoff power. In particular, the 200 foot (61.0 m) sideline noise was reduced from 3 to 4 PNdb at 40 deg for nominal and large nozzle operation. However, the rear quadrant maximum sideline PNL's were increased 1.5 to 3 PNdb at approach thust and up to 2 PNdb at takeoff thust with these serrated rotor blades. The configuration with the serrated rotor produced the lowest maximum 200 foot (61.0 m) sideline PNL for any given thust when the large nozzle (116% of design area) was employed. Author

N74-27297# Dayton Univ. Research Inst., Ohio.
COMPUTER PROGRAMS FOR SINGLE-STAGE AXIAL COMPRESSOR TEST DATA ANALYSIS. VOLUME 1: THEORY, DESCRIPTIONS, AND USER'S INSTRUCTIONS Final Report, 16 Jun. 1971 - 17 Apr. 1972
Richard M. Hearsey Dec. 1973 94 p refs Supercedes AD-744502
(Contract F33615-71-C-1751; AF Proj. 3066; AF Proj. 7065)
(AD-776791; UDRI-TR-72-20; AFAPL-TR-72-43-Vol-1; ARL-73-0177-Vol-1; AD-744502) Avail: NTIS CSCL 21/5

A pair of special-purpose computer programs have been written for the analysis of axial compressor aerodynamic test data. The axisymmetric flow of a thermal-perfect compressible fluid is assumed, and the streamline curvature method of solution is employed. By optionally incorporating details of the blade geometry in the input data, a detailed account of the flow through the blading may be obtained. A unique feature of the analysis is the option to determine annulus blockage due to boundary layers and blade wakes by utilizing experimental wall static pressure readings in addition to the usual traverses of total pressures and temperature. This first volume of two that describe the programs fully details the theory of the method, describes the computer programs, and gives all information necessary to use them. Author (GRA)

N74-27298# Naval Postgraduate School, Monterey, Calif.
REPORT ON THE TESTING OF A HYBRID (RADIAL-TO-AXIAL) COMPRESSOR Final Report, Jul. 1973
Raymond P. Shreeve Nov. 1973 232 p refs
(AD-777027; NPS-57SF73112A) Avail: NTIS CSCL 13/7

A full account is given of a test program to evaluate a prototype hybrid compressor, wherein the flow is turned through 180 degrees (from axial to radial to axial) within the rotor. The initial stator, or diffuser, consisted of two cascades of unswept and untwisted blades arranged and designed as in an axial compressor. The performance was measured with two diffusers of different solidities and with changes in the blade stagger angles. The maximum efficiency approached 80%; however, the flow was separated in the second blade row for all diffuser designs tested. Surveys from hub to tip at the rotor exit revealed an unusually large variation in flow angle. Approximations were obtained from normalized distributions of velocity and angle from all tests which will allow the design of a diffuser with swept or twisted blades. (Modified author abstract) GRA

N74-27299# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFICIENCY OF FILM COOLING ON CERTAIN GAS TURBINE STATOR SURFACES
V. A. Zysin and M. S. Zolotogorov 8 Mar. 1974 13 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Energ. (Minsk), v. 14, no. 5, May 1971 p 48-53
(AD-776742; FTD-HT-23-776-74) Avail: NTIS CSCL 13/5

The effect of high temperature gradients on the service life of gas turbine engine components is discussed. The proposed solution for the temperature problem is to inject a coolant into the main stream parallel to the wall in order to cut off on the boundary of the part of the heat fluxes which are directed from the hot gas to the surface. This cooling method is called boundary cooling. The most accepted method at present is to inject the cooling air through special slits. A numerical analysis of the effectiveness of film cooling was conducted. The parameters which influence the efficiency of film cooling are defined. Author

N74-27300# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), AH-1G GAS TURBINE ENGINE (T53-L-13B) Interim Report, 1 Jan. 1964 - 1 Jul. 1973
Apr. 1974 22 p
(AD-776939; USAAVSCOM-TR-74-20) Avail: NTIS CSCL 21/5

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. Appropriate modes are chosen because of their proportion of the total removals or their proportion in combination with other similar modes. These eliminated removals are then assumed to follow the distribution of the remaining removal modes. The actual cost savings are determined from the increase in the mean time to removal based on the new removal distributions. GRA

N74-27301# Naval Intelligence Support Center, Washington, D.C. Translation Div.
DESIGN AND STRENGTH CALCULATION OF COMPONENTS IN STEAM AND GAS TURBINES

G. S. Zhiritskii and V. A. Strunkin 30 Aug. 1973 30 p Transl. into ENGLISH from the publ. "Konstruktsiya i Raschet na Prochnost Detalei Paravykh i Gazovykh Turbin" Moscow, 1968 33 p
(AD-777378; NISC-Trans-3457) Avail: NTIS CSCL 21/5

The chemical composition, and mechanical and physical properties are considered of materials used for blades and related parts in steam and gas turbines. Erosion factors are identified and the mechanical effects of water, particularly cavitation, are discussed. Tolerable stresses and material characteristics are discussed which are best suited for incorporation in compressors, and steam and gas turbine parts. Materials selections and tolerable stress calculations are given which insure optimal performance and wear for wheels and rotors, shafts, casing, diaphragms, and steel fastenings. A.A.D.

N74-27302# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STANDARDIZATION OF TESTING BENCHES
P. Gourgeon, J. P. Badaroux, and A. Durollet 18 Mar. 1974 45 p Transl. into ENGLISH of Centre d'Essais de Propulseurs, Saclay, France, report no. 998, 1972 p 1-39
(AD-777208; FTD-HC-23-700-74; Rept-998) Avail: NTIS CSCL 21/5

These tests are part of a program of tests scheduled in various SNECMA (National Company for Design and Manufacture of Aircraft Engines) facilities at Villaroche, TURBOMECA installations at Bordes and C.E.Pr facilities, in order to determine the acceptability. The account of the performances under the same conditions should make possible a comparative study among the different test stands. GRA

N74-27303# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING AXISYMMETRICAL GAS FLOW IN TURBINES
V. S. Salnikov 25 Mar. 1974 38 p refs Transl. into ENGLISH from Lopatochnye Mash. Struynye App. (Moscow), no. 6, 1972 p 25-48
(AD-777264; FTD-HT-23-668-74) Avail: NTIS CSCL 21/5

The report is dedicated to improving the methods of calculating axisymmetrical gas flows in turbines. GRA

N74-27304# AiResearch Mfg. Co., Phoenix, Ariz.
PRODUCT SUPPORT PROGRAM (GROUND POWER SYSTEMS) Final Report, 1 Jan. - 31 Dec. 1973
28 Feb. 1974 54 p
(Contract N00019-27-C-0233)
(AD-777704; Rept-74-310545-2) Avail: NTIS CSCL 21/5

The report summarizes the work accomplished under U.S. Navy Contract N00019-73-C-0233 by the AiResearch Manufacturing Company of Arizona, A Division of The Garrett Corporation, during the period from January 1 through December 31, 1973. The following tasks, as authorized by the original contract and subsequent authorization letters, are applicable to AiResearch gas turbines currently in the Navy inventory. The work performed was assigned task numbers and grouped for reporting purposes in air or ground support affiliation, Report Nos. 74-310545-1 and -2, respectively. The units considered in this volume (-2), under contract, were the NCPP-105 ground power unit, the GTC85-72, -76, GTCP100-54, and the GTC100-53, -56 gas turbine engines. Author (GRA)

N74-26814* Naval Air Propulsion Test Center, Trenton, N.J.
EROSION AND THE GAS TURBINE ENGINE, PART 2
J. E. Newhart *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 129-145 refs (For availability see N74-26800 16-12)
CSCL 21E

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-27305 Yale Univ., New Haven, Conn.
ASYMMETRIES OF THE SOLAR Ca 2 LINES Ph.D. Thesis
James Norton Heasley, Jr. 1973 159 p
Avail: Univ. Microfilms Order No. 74-13045

A theoretical study of the influence of propagating acoustic pulses in the solar chromosphere upon the line profiles of the Ca 2 resonance and infrared triplet line was made. The major objective was to explain the observed asymmetries of the core emissions seen in the Ca 2 H and K lines and to predict the temporal behavior of the infrared lines caused by the acoustic or shock pulses. The non-LTE line formation problem was solved using a new version of the complete linearization technique. The new method has the same asymptotic timing and storage requirements as integral equation schemes but does not suffer the self-consistency problems the latter techniques sometimes encounter when problems involving several interlocking radiative transitions are treated. The velocities in the pulses, calculated from weak shock theory, were included consistently in the non-LTE calculations. The results of our calculations show that the lines are very sensitive to the perturbations in the background atmosphere caused by the pulses. Dissert. Abstr.

N74-27306*# Indian National Scientific Documentation Centre, New Delhi.
SOLAR ACTIVITY AND SUDDEN CHANGES IN THE NATURAL PROCESSES ON EARTH: A STATISTICAL ANALYSIS
I. P. Druzhinin and N. V. Khamyaova 1973 311 p refs Transl. into ENGLISH of the publ. "Solnechnaya Aktivnost i Perelomy Khoda Prirodnykh Protsessov na Zemle: Statisticheskii Analiz" Moscow, 1969 Sponsored in part by NASA
(Contract NSF C-466)
(NASA-TT-F-652; TT-70-57264) Avail: NTIS HC $7.25 CSCL 03B

The influence of solar activity on natural terrestrial processes was statistically studied based on the hypothesis that sudden changes in the 11-year cycle lead to changes in the terrestrial processes. Processes discussed include: processes on a planetary scale, atmospheric circulation, precipitation, ocean and sea processes, river runoff, water levels, ice formation, and biological processes. F.O.S.

N74-27307*# Stanford Univ., Calif. Inst. for Plasma Research.
TWO-FLUID MODEL OF THE SOLAR CORONA
J. W. Knight, P. A. Sturrock, and C. E. Newman Mar. 1974 12 p refs
(Grant NGL-05-020-272)
(NASA-CR-138613; SUIPR-566) Avail: NTIS HC $4.00 CSCL 03B

A simple model of the lower corona which allows for a possible difference in the electron and proton temperatures is analyzed. With the introduction of a phenomenological heating term, temperature and density profiles are calculated for several different cases. It is found that, under certain circumstances, the electron and proton temperatures may differ significantly. Author

N74-27308*# Linguistic Systems, Inc., Cambridge, Mass.
SOLAR ENERGY AND THE SEASONAL THERMOCLINE
J. P. Bethoux and A. Ivanoff Washington NASA Jun. 1974 18 p refs Transl. into ENGLISH from "Optics of the Sea (Interface and In-water Transmission and Imaging", AGARD, Nevilly sur Seine, France, report AGARD-LS-61, Aug. 1973 7 p
(Contract NASw-2482)
(NASA-TT-F-15660) Avail: NTIS HC $4.00 CSCL 03B

The annual cycle of the vertical thermocline corresponding to the absorption of solar energy was investigated by underwater photometry. It is shown that solar energy gives rise to a density gradient resulting in the vertical stability of the water. Mathematical models are proposed on the assumption that the thermocline constitutes an effective barrier and considers the turbulent conduction of heat to become negligible. M.C.F.

N74-27309# Joint Publications Research Service, Arlington, Va.
COSMIC RADIATION BURST OBSERVED BY THE KOSMOS-

461 ARTIFICIAL EARTH SATELLITE
Ye. P. Mazets, S. V. Golenetskiy, and V. N. Ilinskiy 5 Jun. 1974 3 p refs Transl. into ENGLISH from Pisma v Zh. Eksp. Teor. Fiz. (Moscow), no. 2, 20 Jan. 1974 p 126-128
(JPRS-62167) Avail: NTIS HC $4.00

Results are presented of observations of a burst of cosmic gamma radiation observed by the Kosmos-461 on 17 January 1972. Author

N74-27310# Joint Publications Research Service, Arlington, Va.
SOLAR CORPUSCULAR STREAMS AND WEATHER ON THE EARTH
N. S. Sidorenkov 7 Jun. 1974 21 p refs Transl. into ENGLISH from Priroda (Moscow), no. 3, 1974 p 14-23
(JPRS-62197) Avail: NTIS HC $4.25

Results are given of an examination of the effect of corpuscular streams on atmospheric circulation and consequently weather on the earth. Author

N74-27311*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A POSSIBLE CORRELATION BETWEEN MAXIMA OF THE FAR ULTRAVIOLET SOLAR IRRADIANCE AND CENTRAL MERIDIAN PASSAGES OF SOLAR MAGNETIC SECTOR BOUNDARIES
Donald F. Heath and John M. Wilcox (Stanford Univ.) May 1974 10 p
(NASA-TM-X-70674; X-912-74-135) Avail: NTIS HC $4.00 CSCL 03B

A description is given of the relationship observed between enahancements in the far ultraviolet solar irradiance and the position of the solar magnetic sector boundaries. The ultraviolet observations were made with the monitor of ultraviolet solar energy (MUSE) experiments which were launched aboard Nimbus 3 in April 1969 and Nimbus 4 April 1970. A comparison between the positions of solar magnetic sector boundaries and ultraviolet enchancements of the sun seems to show, at least during the year of 1969, that the ultraviolet maxima tend to occur near the times when a solar sector boundary is near the central meridian. An estimate of the magnitude of the variable ultraviolet solar energy input into the atmosphere resulting from the rotation of active solar longitudes is that for wavelengths less that 175 nm and down to H Lyman alpha it exceeds the annual variation whereas at longer wavelengths it is less. The total observed peak to peak variation in the ultraviolet irradiance from 120 to 300 nm over a solar rotation is typically at least 230 ergs/sq cm sec. Author

N74-27312# American Science and Engineering, Inc., Cambridge, Mass.
X-RAY EMISSION FROM SOLAR FLARES AND ACTIVE REGIONS Final Scientific Report
Ryszard Gajewski 15 Jan. 1974 13 p refs
(Contract F44620-71-C-0019; AF Proj. 9751)
(AD-777211; ASE-3442; AFOSR-74-0466TR) Avail: NTIS CSCL 03/2

The research conducted under this contract is summarized. Work in the following general areas is described: (1) Calculations of the X-ray emission from a hot plasma; (2) effect on the X-ray spectrum of departure from steady-state ionization conditions during solar flares; (3) cooling mechanisms operating in solar flare plasma; (4) heating of active regions by magnetic energy dissipation; (5) the nature of plasma arcs in solar active regions; and, (6) a model for magnetic field annihilation.
Author (GRA)

N74-27313*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
SHORT DURATION SOLAR MICROWAVE BURSTS AND ASSOCIATED SOFT X-RAY EMISSION
Steven R. Spangler and Stanley D. Shawhan Dec. 1973 41 p refs
(Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-138745; AD-776251; U-of-Iowa-73-43) Avail: NTIS HC $5.25 CSCL 03/2

Using a combination of ground-based and satellite instrumentation, solar flares are being studied over a wide range of wavelengths from radio through optical to X-ray. The purpose of this report is to further delineate parameters about the association of 2-12 A soft X-ray bursts with short duration 15 GHz microwave bursts. In the time period between November 1968 and March 1970, 147 cases of coincident microwave and X-ray flares have been examined to determine the relationships of start times, time of maxima, flux, and energy. GRA

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-27314 Princeton Univ., N.J.
INHOMOGENEOUS MODELS OF THE ATMOSPHERE OF SATURN Ph.D. Thesis
William Wray Macy, Jr. 1973 70 p
Avail: Univ. Microfilms Order No. 74-9701

Model of Saturn's atmosphere is presented. The model consists of a stack of isothermal, isobaric layers whose temperature and pressure are deterimined from a non-grey thermal model whose He/H2 abundance ratio is that of the sun and whose effective temperature is 97 K. The doubling technique has been used to compute the model. The haze has a scattering optical thickness of 8 in the equatorial region and 12 in the temperate region. Dissert. Abstr.

N74-27315 Florida Univ., Gainesville.
SOME STUDIES OF THE JOVIAN UPPER ATMOSPHERE Ph.D. Thesis
Louis Anthony Capone 1973 156 p
Avail: Univ. Microfilms Order No. 74-10032

Ionosphere formation in the Jovian upper atmosphere with special reference to reaction rates are investigated. In the lower regions of the ionosphere, three-body processes leading to the formation of the heavier H3(+) and H3(+) ions which have very fast dissociative recombination rates, produce a large reduction in the electron density. The photochemistry of methane and ammonia has been treated as rigorously as possible. The distribution of atomic hydrogen and products of methane and ammonia photolysis have been obtained. Models for both these boundary conditions are shown in the presentation of the results. The solution of the time dependent coupled continuity equations which describe the altitude distributions of these minor constituents is discussed. Dissert. Abstr.

N74-27316 Maryland Univ., College Park.
GRAVITATIONAL SYNCHROTRON RADIATION Ph.D. Thesis
Paul Lawrence Chrzanowski 1973 193 p
Avail: Univ. Microfilms Order No. 74-13178

In an effort to explain Weber's announced detection of bursts of gravitational radiation, radiation emission is studied by a test particle in the neighborhood of a black hole. What is sought is a source of high frequency, strongly focused (gravitational synchrotron) radiation (GSR). The latitudinal focusing of GSR may be used to explain the high intensity of the reported signals, while the high frequency property enables the radiation emitted by a particle orbiting a 10 to the 8th power solar masses black hole to be in the frequency range monitored by Weber. Scalar radiation emission is considered by a particle moving on an unrealistic, highly energetic circular geodesic. The scalar wave equation in a Kerr background is solved by separation of variables, and the scalar radiation power spectrum is found to have vanishing amplitude for the case where the central black hole is maximally rotating. Dissert. Abstr.

N74-27317 Indiana Univ., Bloomington.
THE ORIGIN AND DISTRIBUTION OF CARBON IN LUNAR SOILS Ph.D. Thesis
David John DesMarais 1974 119 p
Avail: Univ. Microfilms Order No. 74-13512

The distribution of carbon and hydrogen within lunar soils

has been determined by analysis of soil particle types and size fractions by pyrolysis gas chromatography. The mineral glass, and high-grade breccia fragments in the soils examined contain relatively low amounts of carbon and hydrogen. Most low-grade breccias and all agglutinates examined have high carbon contents and hydrogen contents. The partial depletion of all solar wind-derived rare gas elements, relative to carbon, has shown that previous calculations of the solar wind carbon contribution to soils are too low. It is possible that all excess carbon observed in lunar soils, relative to lunar crystalline rocks, derives from the solar wind. Dissert. Abstr.

N74-27318 State Univ. of New York, Stony Brook.
RADIATIVELY INDUCED MOTIONS IN PLANETARY ATMOSPHERES Ph.D. Thesis
Veerabhadran Ramanathan 1973 193 p
Avail: Univ. Microfilms Order No. 74-14013

The purpose of this investigation is twofold and the investigation is presented in two parts. Part I of the investigation concerns a study of the observed strong zonal circulation in the stratosphere of Venus. The zonal circulation is shown to be driven by the diurnal solar heating of the stratosphere. A compressible and radiating atmosphere is considered. Restricting the applicability of the analysis to the equatorial regions, rotational effects are ignored and a two-dimensional model is treated. In part 2 a study of convective overshoot within planetary lower atmospheres is presented. From global entropy balance considerations, it is shown that the Boussinesq equation and the mixing length theory, used conventionally in radiative-convective analyses, do not satisfy the thermodynamic constraints imposed on the lower atmosphere. The thermodynamic analysis also indicates that the mean potential temperature should be a constant within the troposphere.
Dissert. Abstr.

N74-27319* Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY: COMMUNICATIONS NOS. 173-183, VOLUME 9, PART 5
Gerard P. Kuiper, ed. 1973 162 p refs Sponsored by NASA
Original contains color illustrations
(NASA-CR-138630) Avail: NTIS HC $11.25 CSCL 03B

Short discussions are presented on: (1) multicolor photography of Jupiter; (2) narrow band photography of Jupiter and Saturn; (3) photographic observations of the occulation of Beta Scorpii by Jupiter; (4) development of the June 1971 South Equatorial Belt Disturbance on Jupiter; (5) rotation period for subsurface source in the NNTeB of Jupiter; (6) correlation between color of Jovian clouds and their 5 micron temperatures; (7) and observations of Jupiter's North North Temperature Belt Current B. For individual titles, see N74-27320 through N74-27330.

N74-27320* Arizona Univ., Tucson.
INTERPRETATION OF THE JUPITER RED SPOT, 1
Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 245-313 refs (For availability see N74-27319 16-30)
CSCL 03B

With the aid of 8900 micron CH4 filter photographs it is shown that the Red Spot is normally the highest cloud feature in the Jovian atmosphere, located squarely on the South Tropical Zone at 22 deg. S. The Red Spot is a rising column, obviously having its own energy source; it spreads outward at the top level, in anticyclonic rotation. It is concluded that the large and persistent Jovian cloud masses, of which the Red Spot is the largest, are major organized storm arrays embedded in a near stagnant atmosphere, each probably possessing numerous short-lived rising hot columns driven by released latent heat; and covered by a horizontally-expanding gigantic cirrus cloud system, in anti-cyclonic rotation. The meteorological theory of Organized Cumulus Convection is applied to the Red Spot and the White Ovals. Evidence exists that the array of hot towers under the Red Spot is eccentric. The 90-day and the occassional 5-8 year fluctuations in the motion of the Red Spot may be due to processes analogous to those found in the Earth's Tropical Convergence. The 90-day oscillation has been observed for 8 years. Author

N74-27321* Arizona Univ., Tucson.
MULTICOLOR PHOTOGRAPHY OF JUPITER c14
J. W. Fountain and S. M. Larson *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 315-326 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 14E

Examples of wideband filter photography of Jupiter between 1965 and 1970 are reviewed, describing the basic wavelength dependence of the cloud features. The initial results of photography in the 0.89 micron methane band are discussed. Author

N74-27322* Arizona Univ., Tucson.
NARROW-BAND PHOTOGRAPHY OF JUPITER AND SATURN c14
John W. Fountain *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 327-337 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 14E

Jupiter and Saturn were photographed with narrow-bandwidth interference filters from 3000 to 9200A and in the 1-2 micron region with an infrared-sensitive vidicon. Changes with wavelength are noted in the limb darkening and surface detail. Author

N74-27323* Arizona Univ., Tucson.
LATITUDE MEASURES OF JUPITER IN THE 0.89 MICRON METHANE BAND
R. B. Minton *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 339-352 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 03B

Jupiter has been photographed by the Lunar and Planetary Laboratory in the 0.89 micron methane band since October 1968. A photometric evaluation of these photographs has not yet been carried out, but a visual study of this collection and a comparison with the color records has been made. This comparison, together with diameter and latitude measures of the methane records, shows that the albedos and latitudes of most features shown in 0.89 micron vary with time and the albedos and latitudes of most features shown in 0.89 micron vary with time and that there is no simple correlation between the visual color and/or intensity of a feature and its intensity in the methane band. The latitudes of the Red Spot and South Tropical Zone have remained unchanged, while those of the Equatorial Zone, North Tropical Zone, and South Polar Hood have changed. Measures of images taken near opposition show the polar diameter to be within 0.5% of the American Ephemeris Value, but the equatorial diameter as 1.3% smaller. Measures near quadrature suggest a phase defect 3.5 times greater in value than the American Ephemeris value. The large phase defect and bright South Polar Hood contribute to the circular appearance of Jupiter in methane. Latitude variations of the North edge of the South Polar Hood support the 1964 Munch and Younkin hypothesis that this feature is composed of frozen methane. Author

N74-27324* Arizona Univ., Tucson.
PHOTOGRAPHIC OBSERVATIONS OF THE OCCULATION OF BETA SCORPII BY JUPITER
Stephen M. Larson *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 353-359 refs (For availability see N74-27319 16-30)
CSCL 03A

The occultation of the multiple star Beta Scorpii by Jupiter was observed visually and photographically from the Bosscha Observatory in Lembang (Java), Indonesia, on May 13, 1971. The photographs recorded the dimming of the stars as the light was differentially refracted by the Jovian atmosphere, and gave support to a scale height much greater than 8 and more nearly 30 km. In addition, during the ingress of Beta Scorpii, flashes up to 1 second long were observed visually (while guiding in the reflex device of the camera) that occurred irregular intervals, spaced by 2-8 seconds, over a total period of 7 minutes. Measurements of the position of the brightest component of

Beta Scorpii during ingress shows refraction of approximately 1.4 sec before becoming unobservable. Author

N74-27325* Arizona Univ., Tucson.
INITIAL DEVELOPMENT OF THE JUNE 1971 SOUTH EQUATORIAL BELT DISTURBANCE ON JUPITER
R. B. Minton *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 361-369 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 03B

Photographs taken with the Catalina 61-inch reflector from June 21 through July 10, 1971 have permitted study and measurement of early developments of a major South Equatorial Belt (SEB) disturbance. High resolution photographs of the disturbance were obtained on seven nights during the 19-day interval. The first photograph at 04:38 UT on June 21 recorded the initial outbreak at 79.5 deg longitude (System 2), and -14 deg Zenographic latitude. From this point, dark spots moved along the SEBs towards increasing longitude. The preceding white spot had an initial period of 9h54m32.5 tor-3.5s, and retrograding dark spots on the SEBs a mean period of 9h58m30s.5 tor- 7s. The feature from which all the spots emerged had a rotation period of 9h55m29s tor- 2.5s, and is close to the System 3 radio period of 9h55m29.73s tor- 0.04s derived by Carr. Author

N74-27326* Arizona Univ., Tucson.
OBSERVATIONS OF THE SOUTH EQUATORIAL BELT DISTURBANCE ON JUPITER IN 1971
Stephen M. Larson *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 371-383 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 03B

Some aspects of the major South Equatorial Belt disturbance of 1971 are described from photographic observations obtained at the Catalina and Bosscha Observatories. The motions of several spots produced by the disturbance during the first two months of activity were measured. The projection comparator used for measurement is also described. Author

N74-27327* Arizona Univ., Tucson.
ROTATION PERIOD FOR A SUBSURFACE SOURCE IN THE NNTeB OF JUPITER
Gordon Solberg *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 385-387 refs (For availability see N74-27319 16-30)
CSCL 03B

During two consecutive apparitions of Jupiter, 1968-69 and 1969-70, 12 and 9 spots were observed in the North North Temperature Current B (latitude about 35 N). Drift curves were extended on the basis of LPL Jupiter photographs. It is shown that the two source areas for these groups of spots are probably the same, and define a rotation period of the common subsurface source very close to that of System 3. Author

N74-27328* Arizona Univ., Tucson.
A CORRELATION BETWEEN COLORS OF JOVIAN CLOUDS AND THEIR 5 MICRON TEMPERATURES
R. B. Minton *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 389-396 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 03B

Observations of Jupiter at 5 micron by Keay, Low, and Rieke were compared with color photographs by Minton and Kutoroff taken near the same epoch. A strong correlation is evident between the 5 micron temperature distribution on the Jupiter disk and the cloud colors. Further comparison is made with photographs in the .888 micron CH4 absorption band. Strong correlations exist for features in System 2 latitudes at all three wavelengths but not for those that move with System 1. This is attributed to more intensive convection in the Equatorial Zone. Owen's suggestion that colors may result from at least two mechanisms appears valid; a third appears responsible for blue features only. Author

N74-27329* Arizona Univ., Tucson.
RECENT OBSERVATIONS OF JUPITER'S NORTH NORTH TEMPERATURE BELT CURRENT B
R. B. Minton *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 397-402 refs (For availability see N74-27319 16-30)
(Grant NGL-03-002-002)
CSCL 03B

An outbreak of thirteen spots in Jupiter's North North Temperature Belt Current B was observed in 1972. These have been measured and compared with measures of the two most previous outbreaks. The drift in longitude of a hypothetical source supports both Reese's original hypothesis of a subsurface source, and Solberg's observation that its period is close to that of System 3. There is some evidence that long-enduring atmospheric features exist at lower, unobservable depths. Author

N74-27330* Arizona Univ., Tucson.
DISCOURSE FOLLOWING AWARD OF KEPLER GOLD MEDAL
Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab.: Commun. Nos. 173-183, Vol. 9, Part 5 1973 p 403-407 (For availability see N74-27319 16-30)
CSCL 03A

Kuiper briefly reviews Kepler's contributions to the field of planetary astronomy and physics, along with references to his own background in the study of stars, planets, and the solar system. He mentions his participation in NASA programs related to planetary astronomy. He concludes his remarks with thanks for being honored by the award of the Kepler Gold Medal. A.L.

N74-27331*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
FOUR-BODY TRAJECTORY OPTIMIZATION Final Report
C. L. Pu and T. N. Edelbaum Dec. 1973 72 p refs
(Grant NGR-22-009-207)
(NASA-CR-138621; R-778) Avail: NTIS HC $6.75 CSCL 03B

A collection of typical three-body trajectories from the L1 libration point on the sun-earth line to the earth is presented. These trajectories in the sun-earth system are grouped into four distinct families which differ in transfer time and delta V requirements. Curves showing the variations of delta V with respect to transfer time, and typical two and three-impulse primer vector histories, are included. The development of a four-body trajectory optimization program to compute fuel optimal trajectories between the earth and a point in the sun-earth-moon system are also discussed. Methods for generating fuel optimal two-impulse trajectories which originate at the earth or a point in space, and fuel optimal three-impulse trajectories between two points in space, are presented. A brief qualitative comparison of these methods is given. An example of a four-body two-impulse transfer from the Li libration point to the earth is included. Author

N74-27332*# California Univ., Berkeley.
APOLLO SOIL MECHANICS EXPERIMENT S-200 Final Report
J. K. Mitchell, W. N. Houston, W. D. Carrier, III, and N. C. Costes Jan. 1974 135 p refs
(Contract NAS9-11266)
(NASA-CR-134306) Avail: NTIS HC $9.75 CSCL 03B

The physical and mechanical properties of the unconsolidated lunar surface material samples that were obtained during the Apollo missions were studied. Sources of data useful for deduction of soil information, and methods used to obtained the data are indicated. A model for lunar soil behavior is described which considers soil characteristics, density and porosity, strength, compressibility, and trafficability parameters. Lunar history and processes are considered, and a comparison is made of lunar and terrestrial soil behavior. The impact of the findings on future exploration and development of the moon are discussed, and publications resulting from lunar research by the soil mechanics team members are listed. A.A.D.

N74-27333*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LUNAR ELECTRICAL CONDUCTIVITY, PERMEABILITY,AND TEMPERATURE FROM APOLLO MAGNETOMETER EXPERI-

MENTS
P. Dyal, C. W. Parkin, (Santa Clara Univ.), and W. D. Daily, (Brigham Young Univ.) Feb. 1974 45 p refs Prepared in cooperation with Santa Clara Univ. and Brigham Young Univ.
(NASA-TM-X-62353) Avail: NTIS HC $3.25 CSCL 03B

Magnetometers were deployed at four Apollo sites on the moon to measure remanent and induced lunar magnetic fields. Measurements from this network of instruments were used to calculate the electrical conductivity, temperature, magnetic permeability, and iron abundance of the lunar interior. Global lunar fields due to eddy currents, induced in the lunar interior by magnetic transients, were analyzed to calculate and electrical conductivity profile for the moon, and those profiles were used to calculate the lunar temperature for an assumed lunar material of olivine. Simultaneous measurements by magnetometers on the lunar surface and in orbit around the moon were use to construct a whole-moon hysteresis curve, from which the global lunar magnetic permeability is determined. Total iron abundance (sum of iron in the ferromagnetic and paramagnetic states) was calculated for two assumed compositional models of the lunar interior. Other lunar models with an iron core and with a shallow iron-rich layer also discussed in light of the measured global lunar permeability. Simultaneous magnetic field and solar plasma pressure measurements show that the remanent fields at the Apollo 12 and 16 sites interact with, and are compressed by, the solar wind. Velocities and thicknesses of the earth's magnetopause and bow shock were also estimated from simultaneous magnetometer measurements. Author

N74-27334*# Kanner (Leo) Associates, Redwood City, Calif.
THE ATMOSPHERE OF MARS IN THE LANDING AREA OF THE DESCENT APPARATUS OF MARS-6 (PRELIMINARY RESULTS)
V. S. Avduyevskiy, V. I. Alyshin, N. F. Borodin, V. V. Kerzhakovich, Ya. V. Malkov, M. Ya. Marov, S. F. Morozov, V. G. Perminov, M. K. Rozhdestvenskiy, and O. L. Ryabov Washington NASA Jun. 1974 29 p refs Transl. into ENGLISH from "Atmosfera Marsa v Rayone Posadki Spuskayemogo Apparata Mars-6 (predvaritelnyye Rezultaty)" Moscow, Acad. of Sci. USSR, 1974 28 p
(Contract NASw-2481)
(NASA-TT-F-15717) Avail: NTIS HC $4.50 CSCL 03B

The design of the Mars-6DA and its landing system are described. Information transmitted during the descent included measurements of the mutual velocities of the orbital apparatus and the descent apparatus, and measurements of g loads, atmospheric pressure, and altitude above the surface. These data were compared with Doppler measurements performed at the time, and then with models used in plan calculations. A model of the parameters and preliminary estimates of the dynamics of the Martian atmosphere are presented. A.A.D.

N74-27335*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ALGORITHM FOR A GENERAL CLASS OF ROUTING PROBLEMS DERIVED FROM HUYGENS' PRINCIPLE
Lee M. Avis and George R. Young Washington Jun. 1974 19 p refs
(NASA-TN-D-7580; L-9342) Avail: NTIS HC $3.00 CSCL 09B

If a set of N points or nodes with a nonnegative cost associated with each ordered pair is known, it is desired to find a path from one given node to another given node which minimizes the cost sum. An algorithm is presented which yields a global minimum solution after at most N - 1 iterations or on a typical large third-generation computer, after 1 hour of computation time for a 10,000-node problem. The rapid-access data storage capacity demanded by the algorithm is approximately 3N words for costs read in from slow-access storage or 2N words for calculable costs. The time-storage requirements of the algorithm known to the authors. When the problem is viewed as a discretized optimal control problem, after N-1 iterations, an optimal control or node transition is established for each of the N nodes or states; thus, the algorithm can be applied to situations were there may be errors in the control that necessitate a closed loop control that necessitate a closed loop control philosophy. Author

N74-27336*# Smithsonian Astrophysical Observatory, Cambridge, Mass. Center for Astrophysics.
TITANIUM SPALLATION CROSS SECTIONS BETWEEN 30 AND 584 MeV AND Ar-39 ACTIVITIES ON THE MOON
F. Steinburnn and E. L. Fireman Apr. 1974 11 p refs Prepared in cooperation with Harvard Coll. Obs., Cambridge, Mass.
(Grant NGR-09-015-145)
(NASA-CR-134251; SAO-404-068) Avail: NTIS HC $4.00 CSCL 03B

The production cross sections of Ar39 for Ti spallation at 45-, 319-, 433-, and 584-MeV proton energies were measured to be 0.37 + or - 0.09, 12.4 + or - 3.7, 9.1 + or - 2.7, and 17.8 + or - 6.2 mb, respectively. Normalized Ar39 production rates and activities are also derived for protons above 40 MeV and for three differential proton spectra of the type approximately E(- alpha). It is concluded that, even for samples of high-Ti content, Ti spallation by solar protons below 200-MeV energy does not contribute significantly to their Ar39 radioactivity. Author

N74-27337# Specola Vaticana (Vatican City).
THE VATICAN OBSERVATORY Annual Report, 1973
1973 16 p refs Original contains color illustrations
Avail: NTIS HC $4.00

The annual report contains information on the following: (1) staff; (2) instrumentation and buildings; (3) astronomical research; (4) stellar and interstellar polarimetry (5) spectroscopy; (6) congresses and visits. A.A.D.

N74-27338*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TEMPERATURE AND ELECTRICAL CONDUCTIVITY OF THE LUNAR INTERIOR FROM MAGNETIC TRANSIENT MEASUREMENTS IN THE GEOMAGNETIC TAIL
Palmer Dyal (Santa Clara Univ., California), Curtis W. Parkin (Brigham Young Univ., Provo, Utah), and William D. Daily [1973] 36 p refs Prepared in cooperation with Santa Clara Univ. and Brigham Young Univ.
(Grants NGR-05-017-027; NGR-45-001-040)
(NASA-TM-X-70083) Avail: NTIS HC $5.00 CSCL 03B

Magnetometers have been deployed at four Apollo sites on the moon to measure remanent and induced lunar magnetic fields. Measurements from this network of instruments have been used to calculate the electrical conductivity, temperature, magnetic permeability, and iron abundance of the lunar interior. Global lunar fields due to eddy currents, induced in the lunar interior by magnetic transients in the geomagnetic tail field, have been analyzed to calculate an electrical conductivity profile for the moon. This profile is generally consistent with conductivity results from transient response analysis in the solar wind, using data measured on the lunar nightside. A temperature profile is calculated from conductivity. Temperature rises rapidly with depth to 1100 K at 200 km depth, then less rapidly to 1800 K at 1000 km depth. Velocities and thickness of the earth's magnetopause and bow shock are estimated from simultaneous magnetometer measurements. Author

N74-27339*# Kansas State Univ., Manhattan. Dept. of Physics.
INFRARED LABORATORY STUDIES OF SYNTHETIC PLANETARY ATMOSPHERES Semiannual Status Report, 1 Dec. 1973 - 31 May 1974
Dudley Williams 20 Jun. 1974 21 p refs
(Grant NGR-17-001-026)
(NASA-CR-138590) Avail: NTIS HC $4.25 CSCL 03B

Research involving a test of multiplicative transmittance for mixed absorbing gases when their lines are broadened by H2 and He, which are constituents of the atmospheres of the major planets was conducted. The results indicate that the multiplicative law as originally formulated can be applied with confidence. The broadening of individual lines in the CO fundamental by various gases has been investigated. The results indicate that the ratio of the self-broadening ability of CO to the line-broadening ability of foreign gases is greater for lines in the band wings than for lines near the band center when the molecular mass of the broadener is less than that of CO. The results have been interpreted in terms of a phenomenological theory. Studies of the relative line broadening abilities of foreign gases have provided

information that can be used to provide optical collision cross sections for individual lines in the CO fundamental. Author

N74-27340*# Arizona Univ., Tucson. Field Emission and Space Systems Lab.
DETECTION TECHNIQUES FOR TENUOUS PLANETARY ATMOSPHERES Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
Stuart A. Hoenig, James E. Summerton, Jerry D. Kirchner, and Jimmie B. Allred 30 Jun. 1974 77 p refs
(Grant NGL-03-002-019)
(NASA-CR-138523; SAPR-22) Avail: NTIS HC $7.00 CSCL 03B

The development of new types of detectors for analysis of planetary atmospheres is discussed. Initially, the interest was in detectors for use under partial vacuum conditions; recently, the program has been extended to include detectors for use at one atmosphere and adsorption systems for control and separation of gases. Results to date have included detector for O2 and H2 under partial vacuum conditions. Experiments on detectors for use at high pressures began in 1966; and systems for CO, H2, and O2 were reported in 1967 and 1968. In 1968 studies began on an electrically controlled adsorbent. It was demonstrated that under proper conditions a thin film of semiconductor material could be electrically cycled to absorb and desorb a specific gas. This work was extended to obtain quantitative data on the use of semiconductors as controllable adsorbents. Author

N74-27341*# Pittsburgh Univ., Pa.
CROSS SECTION CALCULATIONS OF ASTROPHYSICAL INTEREST Final Technical Report
Edward Gerjuoy [1974] 7 p refs
(Grant NGR-39-011-150)
(NASA-CR-138600) Avail: NTIS HC $4.00 CSCL 03B

Cross sections are discussed for rotational excitation associated with theories of absorption and emission lines from molecules in space with emphasis on H2CO, CO, and OH by collisions with neutral particles such H, H2, and He. The sensitivity of the Thaddeus equation for the H2CO calculation is examined. F.O.S.

N74-27342*# Texas A&M Univ., College Station. Dept. of Physics.
RADIATIVE TRANSFER IN REALISTIC PLANETARY ATMOSPHERES Semiannual Report, 1 Oct. 1973 - 1 Apr. 1974
Gilbert N. Plass and George W. Kattawar 31 Mar. 1974 7 p refs
(Grant NGR-44-001-117)
(NASA-CR-138601) Avail: NTIS HC $4.00 CSCL 03B

The research accomplished during this period is briefly summarized. The interior radiances within an optically deep absorbing medium scattering according to the Haze L phase function is discussed along with a method for calculating the radiance and color of the twilight sky. The application of the matrix operator method to calculations of radiance, polarization, and ellipticity of the radiation scattered from homogeneous layers scattering is reported. Reports, and publications are listed. F.O.S.

N74-27343*# Lowell Observatory, Flagstaff, Ariz.
STUDIES IN PLANETOLOGY, INCLUDING THE COLLECTION AND INTERPRETATION OF PLANETARY INFORMATION Semiannual Status Report, 1 Jul. - 31 Dec. 1973
William A. Baum, Robert L. Millis, and Edward L. G. Bowell 29 Mar. 1974 18 p refs
(Grants NGR-03-003-001; NGR-03-003-007)
(SASR-21) Avail: NTIS HC $4.00 CSCL 03A

The value of synoptic imaging of the planets is reported. The advantage of the Large Space Telescope, as compared with ground-based telescopes and planetary orbiters and flybys, is discussed. Desirable LST camera parameters and observing strategies are considered from the standpoint of synoptic imaging. Author

N74-27344# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 325
24 May 1974 53 p refs Transl. into ENGLISH from various Russian Journals
(JPRS-62094) Avail: NTIS HC $5.75

The report contains translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N74-27345*# Toledo Univ., Ohio.
CALCULATION OF THE TOTAL ELECTRON EXCITATION CROSS SECTION IN THE BORN APPROXIMATION USING SLATER WAVE FUNCTIONS FOR THE Li (2s YIELDS 2p), Li (2s YIELDS 3p), Na (3s YIELDS 4p), Mg (3p YIELDS 4s), Ca (4s YIELDS 4p) AND K (4s YIELDS 4p) EXCITATIONS M.S. Thesis
P. L. Simsic [1974] 65 p refs
(Grant NGR-36-010-017)
(NASA-CR-138906) Avail: NTIS HC $6.25 CSCL 03B

Excitation of neutral atoms by inelastic scattering of incident electrons in gaseous nebulae were investigated using Slater Wave functions to describe the initial and final states of the atom. Total cross sections using the Born Approximation are calculated for: Li(2s yields 2p), Na(3s yields 4p), k(4s yields 4p). The intensity of emitted radiation from gaseous nebulae is also calculated, and Maxwell distribution is employed to average the kinetic energy of electrons. M.C.F.

N74-27346*# Hale Observatories, Pasadena, Calif.
PHOTOELECTRIC SPECTROPHOTOMETRY OF OQ 172 AND OH 471
J. B. Oke [1974] 19 p refs
(Grant NGL-05-002-134)
(NASA-CR-138610) Avail: NTIS HC $4.00 CSCL 03A

Absolute spectral energy distributions for the large redshift quasars OQ 172 and OH 471 are discussed along with similar data for two other quasars 4C05.34 and PHL 957. Assuming cosmological redshifts, OQ 172 and OH 471 are not as luminous as PHL 957. If these quasars are basically similar and if radiative processes dominate, the strength of Ly alpha and the behavior of the continuum at the Lyman limit strongly suggest that these objects consist of a central ionizing source surrounded by discrete clouds, filaments or a gaseous structure such as a disk. This gaseous matter does not cover the whole solid angle surrounding the source. Author

N74-27347*# Texas Univ., Austin. Dept. of Astronomy.
MARINER 9 HIGH-RESOLUTION ALBEDO MAPPING OF MARS Final Technical Report, 1 Jul. 1973 - 30 Jun. 1974
G. DeVaucouleurs 30 Jun. 1974 41 p refs
(Grant NGR-44-012-279)
(NASA-CR-138696) Avail: NTIS HC $5.25 CSCL 03B

Large and small scale albedo markings obtained from Mariner 9 photographs and ground based telescope observations are shown on quadrangle charts with a scale of 1:5,000,000. Mercator and stereographic projections at the same scale are presented of the various regions of Mars along with explanatory information about their preparation. Changes in the albedo for the Solis Lacus area were observed and are compared with previous data for the same region. Large scale relief maps covering up to 1.7 million sq miles of the Martian surface are included. A.A.D.

N74-27348*# Indiana Univ., Bloomington. Dept. of Astronomy.
SCANNER OBSERVATIONS OF SELECTED COOL STARS
Theodore D. Fay, Jr. (Alabama Univ., University), William L. Stein, and Wayne H. Warren, Jr. 27 Mar. 1974 35 p refs Submitted for publication
(Grant NGL-15-003-002)
(NASA-CR-138777) Avail: NTIS HC $4.75 CSCL 03A

Photoelectric spectral scans at 30-A resolution of 9 dwarfs, 10 giants and 6 supergiants with spectral types GO to M5 were presented. All stars were observed every 4 A from wavelength 3300 to wavelength 7000. Absorption features at this resolution coincide with: strong atomic lines of Fe 1,11, Ca 1,11, Mg 1, and Na 1; vibrational bands of the electronic

transitions of TiO, MgH, CaH, SiH, AlH, Cn, Ch, C2, OH, and NH. The dependence of the wavelength 3740 Fe 1 blend and the wavelength 3440 depression on temperature is discussed.
Author

N74-27349*# California Inst. of Tech., Pasadena.
LUNAR STUDIES
Andrew P. Ingersoll 18 Jun. 1974 7 p
(Grant NGR-05-002-158)
(NASA-CR-138774) Avail: NTIS HC $4.00 CSCL 03B

Two research projects to classify lunar photographic images are reported. The feasibility of using polarimetry to study large scale features on the moon was investigated. A system was built that measured polarization by subtracting two film images taken through perpendicular Polaroid filters, however, no new boundaries were discovered in the pictures which are not already discernable in ordinary photographs. The present status and equipment of a microfiche library system which would allow easy access to selected lunar photographs from all space missions is also reported. A.A.D.

N74-27350*# Stanford Univ., Calif.
HIGH RESOLUTION OBSERVATIONS OF JOVIAN MAGNETOSPHERIC MICROWAVE SYNCHROTRON EMISSION Final Technical Report
L. R. DAddario and S. J. Wernecke Jun. 1974 50 p refs
(Grant NGR-05-020-644)
(NASA-CR-138778) Avail: NTIS HC $5.50 CSCL 03B

High resolution radio observations of Jupiter were investigated with the use of the Stanford synthesis telescope. The best fit disk was computed from the emission of Jupiter and the residual brightness, due to nonthermal mechanisms was measured.
M.C.F.

N74-27351*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMIC TECHNIQUES FOR STUDIES OF SECULAR VARIATIONS IN POSITION FROM RANGING TO SATELLITES
David E. Smith, Ronald Kolenkiewicz, Russell W. Agreen, and Peter J. Dunn (Wolf Res. and Develop. Corp., Riverdale, Md.) May 1974 34 p refs Presented at IAG Symp. - The Earth's Gravitational Field and Secular Variations in Position, Sydney, Nov. 1973
(NASA-TM-X-70677; X-921-74-161) Avail: NTIS HC $4.75 CSCL 22A

Satellite laser range measurements were applied to the study of latitude variation arising from polar motion, and the solid-earth and ocean tidal distortion of the earth's gravity field. Experiments involving two laser tracking stations were conducted. The relative location of one station with respect to the other was determined by performing simultaneous range measurements to a satellite from two stations several hundred kilometers apart. The application of this technique to the San Andreas Fault Experiment in California is discussed. Future capabilities of spacecraft equipped with laser retroreflectors include: (1) determination of the product of the earth's mass and gravitational constant; (2) measurement of crustal and tectonic motions; (3) determination of the elastic response of the solid-earth tidal forces; (4) measurement of the amplitudes and phase of certain components of the ocean tides; and (5) self-monitoring of the latitude and height variations of the tracking station. Author

N74-27352*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROAD PROGRAM
C. A. Wagner, B. C. Douglas (Wolf R and D Corp., Riverdale, Md.), and R. G. Williamson (Wolf, R and D Corp., Riverdale, Md.) Jan. 1974 42 p refs
(NASA-TM-X-70676; X-921-74-144) Avail: NTIS HC $5.25 CSCL 22C

The philosophy, history, operation, calibration of and some analyses with the ROAD (Rapid Orbit Analysis and Determination) program are described. This semi-numeric trajectory program integrates and analyses mean element variations for earth orbits with great efficiency. Through it's use, extensive zonal, resonant harmonic and earth tidal determinations have been made at Goddard Space Flight Center since 1969. Author

N74-27353# Hermann Oberth-Gesellschaft, Gesellschaft zur Foerderung der Erforschung und Erschliessung des Weltraums e. V., Hannover (West Germany).
INDUSTRIAL EVOLUTION AND REVOLUTION IN THE CISLUNAR SPACE, 1980 - 2010 [INDUSTRIELLE EVOLUTION UND REVOLUTION IM GEOLUNAREN RAUM 1980-2010]
Krafft A. Ehricke (North American Rockwell, Downey, Calif.) 1973 52 p refs In GERMAN Presented at the 21st Aeronautics Meeting of the Hermann-Oberth Ges., Garmisch-Partenkirchen, West Ger., Sep. 1972
(Astronaut-FB-32; SD-72-SA-0173) Avail: NTIS HC $5.75

The industrial evolution and revolution in geolunar space after 1900 is discussed. Topics include industrial ecology of the open world, growth by extraterrestrial industrialization, and space industry. Energy supply from space, notably electricity generation in space, energy supply by solar rays (the Soletta concept), electricity generation on earth, and worldwide distribution through relay stations in space, is dealt with. ESRO

N74-27354# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
DIGITAL COMPUTER PROGRAMS FOR THE ANALYSIS OF DIRECTIONALLY CONTROLLED MISSILES
W. Curtis Brown 5 Dec. 1973 65 p refs
(DA Proj. 1M2-62303-A-214)
(AD-776324; RG-73-33) Avail: NTIS CSCL 16/2

In the system analysis of directionally controlled missiles, much time is spent determining the system parameters to give an optimum trajectory and the determination of missile accuracy. The purpose of the report is to document two digital simulation programs, written in FORTRAN 4, which were developed to accomplish these tasks. The report is written to provide as much help as possible to prospective users and with the assumption that the prospective users have a theoretical knowledge of directionally controlled missile guidance and control systems.
Author (GRA)

N74-27355# Owens Valley Radio Observatory, Pasadena, Calif.
FURTHER OBSERVATIONS AT THE INTERSTELLAR DEUTERIUM FREQUENCY
Diego A. Cesarsky and Jay M. Pasachoff 1974 11 p refs Prepared in cooperation with Williams College, Williamstown, Mass.
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-776284; Rept-1974-3) Avail: NTIS CSCL 03/2

The authors repeated observations of the galactic center in the vicinity of the deuterium ground-state hyperfine transition at 327 MHz. In this year's observations, they tried to use a wider bandwidth to better match the possible line shape while increasing the baseline. Not all the baseline appears interference free, and the overall noise level after 40 hours on source to last year's. The absorption dip that would correspond to a deuterium line at v(LSR)--3.7 km/sec again appears,with a comparable, statistically insignificant strength. Merging the data from both years gives an upper limit of 3.5 x 10 to the minus 4th power and a range, if the absoprtion is the deuterium line, from 3.5 x 10 to the minus 4th power to 2 x 10 to the minus 5th power. This implies cosmic densities insufficient to close the universe. Author (GRA)

N74-27356# Owens Valley Radio Observatory, Pasadena, Calif.
THE RAPIDLY VARIABLE RADIO SOURCE 3C120
G. A. Seielstad 1974 25 p refs
(Contract N00014-67-A-0094-0019)
(AD-776283; Rept-1974-2) Avail: NTIS CSCL 03/2

Flux density and very long baseline interferometric measurements of 3C120 at several wavelengths and times have been analyzed in terms of a model proposed by Ozernoy and Sazonov (1969). Highly satisfactory agreement is achieved if explosive outbursts, each releasing a few times 10 to the 51st power erg, have occurred approximately every 1.2 years since 1967.0. Each outburst ejects a pair of radio plasmoids in opposite directions at moderately relativistic velocities. The individual components expand, also relativistically, as they travel outward. The rate of component expansion is just sufficient to ensure that inverse Compton losses are negligible. Author (GRA)

N74-27357# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
GLOBAL SMALL-SCALE MAPPING OF THE MOON
Yu. N. Lipskii Feb. 1974 15 p refs Transl. into ENGLISH from Akad. Nauk. SSSR Inst. Kosmich. Issled. (USSR), 1973 p 162-168
(AD-775878; DMAAC-TC-2002) Avail: NTIS CSCL 03/2

The 1:5,000,000 full map of the moon and the 1:10,000,000 lunar globe were compiled by the Shternberg Institute together with the topogeodetic service of the U.S.S.R. The full map of the moon is intended for the solution of a series of scientific problems connected with the investigation of the moon and the distribution of formations on its surface. The navigational projection of the map makes it possible to use it for plotting the paths of trajectories of artificial lunar satellites and for planning space experiments. GRA

N74-27358# Aerospace Corp., El Segundo, Calif. Lab Operations.
OBSERVATIONS OF GALACTIC CARBON MONOXIDE EMISSION AT 2.6 MILLIMETERS Report for Jan. 1972 - Oct. 1973
William J. Wilson, P. R. Schwartz, Eugene E. Epstein, Walter A. Johnson, and Robert D. Etcheverry 25 Feb. 1974 42 p refs (Contract F04701-73-C-0074)
(AD-776042; TR-0074(9230-03)-2; SAMSO-TR-74-42) Avail: NTIS CSCL 03/2

A wide variety of galactic sources have been observed at 2.6 mm (115271.2 MHz) to determine the extent and strength of interstellar 12C16O. Extended regions of CO emission were found in the direction of 32 HII regions and five supernova remnants. The CO emission was found to be larger in spatial extent than the 6-cm continuum HII emission and CO emission maxima appear to be related to continuum emission peaks and infrared sources in several sources. Except near optically dark nebulae, little CO emission was detected away from the galactic plane. Radial velocities of the CO emission are within 10/kms of the OH, HII (109 alpha), and H2CO velocities measured by other observers for the same sources. 13C16O was also measured in many of the stronger sources. The optical depths calculated for 12C16O range between 20 and 120, assuming the terrestrial value of 1/89 for the ratio of 13C/12C. For excitation temperatures in the range 10 to 50K, the calculated projected densities range from 10 to the 18th power to 2.5 x 10 to the 19th power molecules/sq cm. Author (GRA)

N74-27359# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPECIFIED FINITE SERIES CONTROL FOR THREE-DIMENSIONAL, MULTI-PHASE, OPTIMAL REENTRY M.S. Thesis
Ralph W. Holm Dec. 1973 114 p refs
(AD-777266; GA/EE/73A-2) Avail: NTIS CSCL 22/3

An optimal, three-dimensional, multi-phase reentry problem is based on NASA's Mission 1 with a vehicle like the Nr-ATP delta-wing vehicle's equations of motion include earth rotation but are developed for relative velocity and express the vehicle's position relative to a reference trajectory plane which is fixed to the earth. The reentry trajectory is divided into two phases. An entry phase from reentry at 400,000 ft to first pullup is optimized with respect to pullup heat rate by maintaining 0 degree roll angle. An equilibrium-glide phase from pullup to termination at 143,000 ft is optimized by varying roll angle to minimize terminal errors, total heat absorbed, and functions of heat rate and flight path angle rate. The roll control function is formulated as a specified finite series of terms, with each term being a function of system states and having a constant coefficient. (Modified author abstract) GRA

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N74-27360* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ROCKET HAVING BARIUM RELEASE SYSTEM TO CREATE ION CLOUDS IN THE UPPER ATMOSPHERE Patent
Beverly W. Lewis, Charles S. Stokes (Temple Univ. Res. Inst.), Edward W. Smith (Temple Univ. Res. Inst.), and William J. Murphy, inventors (to NASA) (Temple Univ. Res. Inst.) Issued 4 Jun. 1974 5 p Filed 28 Apr. 1972 Continuation-in-part of US Patent Appl. SN-59892, filed 31 Jul. 1970 Sponsored by NASA
(NASA-Case-LAR-10670-2; US-Patent-3,813,875; US-Patent-Appl-SN-248761; US-Patent-Class-60-39.46; US-Patent-Class-60-214; US-Patent-Class-60-215; US-Patent-Class-102-90; US-Patent-Appl-SN-59892) Avail: US Patent Office CSCL 16E

A chemical system for releasing a good yield of free barium atoms and barium ions to create ion clouds in the upper atmosphere and interplanetary space for the study of the geophysical properties of the medium is presented.
Official Gazette of the U.S. Patent Office

N74-27361 Stanford Univ., Calif.
STATION-KEEPING FOR A TRANSLUNAR COMMUNICATION RELAY SATELLITE Ph.D. Thesis
Martin Jay Ratner 1974 80 p
Avail: Univ. Microfilms Order No. 74-13679

A translunar communication station is to be kept close to a nominal unstable periodic Halo orbit, visible at all times from earth. The analytically computed nominal orbit is not perfect, requiring an average control acceleration of about .000010 g for tight control. An adjustable quadratic combination of position deviation and control acceleration is minimized to provide an (adjustable) control law with periodic feedback gains and a periodic bias. The average control acceleration can be reduced to less than 10 to the minus 8th power g with an error settling time of less than 2 to 1/2 months. The resulting limiting motion provides, in turn, an improved nominal, permitting the same low control cost with much tighter control, corresponding to settling times on the order of one day. Spectral factorization is used to compute the feedback gains and limiting behavior of this periodic system. The effects of dynamic and state-measurement noise on the system are analyzed. Dissert. Abstr.

N74-27362*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE 1973 SMITHSONIAN STANDARD EARTH (3)
E. M. Garoschkin, ed. 28 Nov. 1973 405 p refs
(Grant NGR-09-015-002)
(NASA-CR-138586; SAO-Special-Rept-353; SAO-311-002) Avail: NTIS HC $23.25 CSCL 22C

The origins of the satellite geodesy program are described, starting with the International Geophysical Year, continuing through a number of international programs, and culminating with the National Geodetic Satellite Program. The philosophical basis for the Baker-Nunn camera and the laser ranging system, the evolution of international scientific cooperation, and the significance of the results are discussed. Author

N74-27363*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STANDARDIZED FUNCTIONAL SUPPORT SECTIONAL FOR THE SMALL ASTRONOMY SATELLITE (SAS)
Marjorie R. Townsend Washington Jun. 1974 35 p refs
(NASA-TN-D-7725; G-7454) Avail: NTIS HC $3.25 CSCL 22B

The standardized functional support section for the improved Small Astronomy Satellite (SAS) spacecraft, which can be used virtually without change for a wide variety of experimental packages and missions, is described. This functional support section makes the spacecraft remarkably flexible for a small satellite. Able to point its thrust axis to any direction in space, it can also spin or slow its outer body rotation to zero for star- or earth-locked pointing of side-viewing experiments. It features a reprogrammable telemetry system, a delayed command system, and an improved control system. Experiments can be built independently and attached to the SAS spacecraft just prior to final acceptance testing and launch. The spacecraft subsystems are described in detail. Included are a summary of the spacecraft

characteristics, special design considerations, project reliability requirements, and environmental test conditions. It is intended that this new functional support section afford virtual off-the-shelf availability of the SAS spacecraft to independently built experiments, thus providing quick response time and minimum cost in meeting a wide variety of experimenter needs. Author

N74-27364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS EXPLORER MISSIONS (AEM): MISSION PLANNERS HANDBOOK
Sterling R. Smith, ed. May 1974 157 p
(NASA-TM-X-69906) Avail: NTIS HC $11.00 CSCL 22B

The Applications Explorer Missions (AEM) Program is a planned series of space applications missions whose purpose is to perform various tasks that require a low cost, quick reaction, small spacecraft in a dedicated orbit. The Heat Capacity Mapping Mission (HCMM) is the first mission of this series. The spacecraft described in this document was conceived to support a variety of applications instruments and the HCMM instrument in particular. The maximum use of commonality has been achieved. That is, all of the subsystems employed are taken directly or modified from other programs such as IUE, IMP, RAE, and Nimbus. The result is a small versatile spacecraft. The purpose of this document, the AEM Mission Planners Handbook (AEM/MPH) is to describe the spacecraft and its capabilities in general and the HCMM in particular. This document will also serve as a guide for potential users as to the capabilities of the AEM spacecraft and its achievable orbits. It should enable each potential user to determine the suitability of the AEM concept to his mission. Author

N74-27365*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
ASTRIONICS SYSTEM DESIGNERS HANDBOOK, VOLUME 1
19 Nov. 1973 379 p refs
(Contract NAS8-14000)
(NASA-CR-120229; IBM-73W-00315-Vol-1) Avail: NTIS HC $22.00 CSCL 22B

Hardware elements in new and advanced astrionics system designs are discussed. This cost effective approach has as its goal the reduction of R&D and testing costs through the application of proven and tested astrionics components. The ready availability to the designer of data facts for applicable system components is highly desirable. The astrionics System Designers Handbook has as its objective this documenting of data facts to serve the anticipated requirements of the astrionics system designer. Eleven NASA programs were selected as the reference base for the document. These programs are: ATS-F, ERTS-B, HEAO-A, OSO-I, Viking Orbiter, OAO-C, Skylab AM/MDA, Skylab ATM, Apollo 17 CSM, Apollo 17 LM and Mariner Mars 71. Four subsystems were chosen for documentation: communications, data management, electrical power and guidance, navigation and control. Author

N74-27366*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
ASTRIONICS SYSTEM DESIGNERS HANDBOOK, VOLUME 2
19 Nov. 1973 264 p refs
(Contract NAS8-1400)
(NASA-CR-120230; IBM-73W-00315-Vol-2) Avail: NTIS HC $16.25 CSCL 22B

For abstract, see N74-27365.

N74-27367*# National Academy of Sciences - National Research Council, Washington, D.C. Space Science Board.
SCIENTIFIC USES OF THE SPACE SHUTTLE
1974 214 p refs
(Contract NASw-2509)
(NASA-CR-138905) Avail: NTIS HC $13.75 CSCL 22B

A survey was conducted to determine the possible missions which could be accomplished by the space shuttle. The areas of scientific endeavor which were considered are as follows: (1) atmospheric and space physics, (2) high energy astrophysics, (3) infrared astronomy, (4) optical and ultraviolet astronomy, (5) solar physics, (6) life sciences, and (7) planetary exploration. Specific projects to be conducted in these broader areas are defined. The modes of operation of the space shuttle are analyzed. Instruments and equipment required for conducting the experiments are identified. Author

N74-27368*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
INVESTIGATION OF HIGHLY EFFICIENT SATELLITE SOLUTION METHODS Final Report, 1 Mar. 1973 - 28 Feb. 1974
Paul E. Nacozy and Gerhard Scheifele 6 May 1974 20 p refs
(Grant NGR-44-012-255)
(NASA-CR-138593) Avail: NTIS HC $4.00 CSCL 22B

Methods for analyzing the stability of satellites are discussed. The subjects considered are: (1) time elements, (2) stabilization by external energy corrections, and (3) long term global solutions for the synchronous satellite. A set of canonical two-body elements referred to as Delaunay-similar elements is presented. In contrast to the classical Delaunay theory which has time as the independent variable, the D-S theory uses an independent variable which is a generalized true anomaly. The numerical integration of the canonical perturbation equations of these elements is developed. Author

N74-27369*# Martin Marietta Corp., Denver, Colo.
LIGHTWEIGHT THERMALLY EFFICIENT COMPOSITE FEEDLINES, PRELIMINARY DESIGN AND EVALUATION Topical Report, Aug. 1973 - Feb. 1974
D. E. Spond, R. E. Holzworth, and C. A. Hall Jun. 1974 117 p refs
(Contract NAS3-17796)
(NASA-CR-134631) Avail: NTIS HC $9.00 CSCL 22B

Six liquid hydrogen feedline design concepts were developed for the cryogenic space tug. The feedlines include composite and all-metal vacuum jacketed and non-vacuum jacketed concepts, and incorporate the latest technology developments in the areas of thermally efficient vacuum jacket end closures and standoffs, radiation shields in the vacuum annulus, thermal coatings, and lightweight dissimilar metal flanged joints. The feedline design concepts were evaluated on the basis of thermal performance, weight, cost, reliability, and reusability. It is shown that composite tubing provides improved thermal performance and reduced weight for each design concept considered. Approximately 12 kg (26 lb.) can be saved by the use of composite tubing for the LH2 feedline and the other propulsion lines in the space tug. Author

N74-27370*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DESIGN, FABRICATION, TESTING, AND DELIVERY OF SHUTTLE HEAT PIPE LEADING EDGE TEST MODULES. VOLUME 2: TECHNICAL REPORT Final Report
20 Apr. 1973 68 p refs
(Contract NAS8-28656)
(NASA-CR-138673; MDC-E0775) Avail: NTIS HC $6.50 CSCL 22B

Development in the design of leading heat pipes for the space shuttle are reported. The analysis, design, and integration of the heat pipes into the module structure are described along with the recommended tests. Results indicate the design goals were meet. M.C.F.

N74-27371*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 1: EXECUTIVE SUMMARY Final Report
S. D. Dorfman Jul. 1973 96 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137488) Avail: NTIS HC $8.00 CSCL 22B

The NASA Ames Research Center Pioneer Venus Project objective is to conduct scientific investigations of the planet Venus using spin stabilized spacecraft. The defined approach to accomplish this goal is to implement a multiprobe spacecraft mission and an orbiter spacecraft mission. Candidate launch vehicles for the Pioneer Venus missions were the Thor/Delta and Atlas/Centaur. The multiprobe spacecraft consists of a probe bus, one large probe, and three small probes. The probes are designed to survive to the surface of Venus, and to make in situ measurements of the Venusian atmosphere; the probe bus

enters the atmosphere and makes scientific measurements until it burns out. The orbiter mission uses a spacecraft designed to orbit Venus for 225 days with an orbit period of about 24 hours (h). The probe bus and orbiter designs are to use a common spacecraft bus. Author

N74-27372*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 2: SCIENCE Final Report
L. K. Acheson Jul. 1973 590 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137489) Avail: NTIS HC $32.50 CSCL 22B

The objectives of the low-cost Pioneer Venus space probe program are discussed. The space mission and science requirements are analyzed. The subjects considered are as follows: (1) the multiprobe mission, (2) the orbiter mission, (3) science payload accomodations, and (4) orbiter spacecraft experimental interface specifications. Tables of data are provided to show the science allocations for large and small probes. Illustrations of the systems and components of various probe configurations are included. Author

N74-27373*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 3: SYSTEMS ANALYSIS Final Report
J. N. Fisher et al Jul. 1973 223 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137490) Avail: NTIS HC $14.25 CSCL 22B

The mission, systems, operations, ground systems, and reliability analysis of the Thor/Delta baseline design used for the Pioneer Space Probe are discussed. Tradeoff decisions concerning spin axis orientation, bus antenna design, communication system design, probe descent, and reduced science payload are analyzed. The reliability analysis is made for the probe bus mission, large probe mission, and small probe mission. Detailed mission sequences were established to identify critical areas and provide phasing of critical operation. Author

N74-27374*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 4: PROBE BUS AND ORBITER SPACECRAFT VEHICLE STUDIES Final Report
J. M. Bozajian et al Jul. 1973 255 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137491) Avail: NTIS HC $15.75 CSCL 22B

The requirements, trades, and design descriptions for the probe bus and orbiter spacecraft configurations, structure, thermal control, and harness are defined. Designs are developed for Thor/Delta and Atlas/Centaur launch vehicles with the latter selected as the final baseline. The major issues examined in achieving the baseline design are tabulated. The importance of spin axis orientation because of the effect on science experiments and earth communications is stressed. Author

N74-27375*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 5: PROBE VEHICLE STUDIES Final Report
L. J. Nolte, D. S. Stephenson et al Jul. 1973 625 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137492) Avail: NTIS HC $34.25 CSCL 22B

A summary of the key issues and studies conducted for the Pioneer Venus spacecraft and the resulting probe designs are presented. The key deceleration module issues are aerodynamic configuration and heat shield material selection. The design and development of the pressure vessel module are explained. Thermal control and science integration of the pressure vessel module are explained. The deceleration module heat shield, parachute and separation/despin are reported. The Thor/Delta and Atlas/Centaur baseline descriptions are provided. Author

N74-27376*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 6: POWER SUBSYSTEM STUDIES Final Report
H. F. Prochaska et al Jul. 1973 160 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137493) Avail: NTIS HC $11.00 CSCL 22B

Selection of a baseline power subsystem for the probe bus, orbiter, and large and small probes has been performed as a part of the Pioneer Venus Mission Systems Design Study. In each case the selection process has involved trades and incorporated the results of previous related studies. Factors considered primary in the selection of each subsystem approach were cost, and the ability of each of the proposed subsystems to perform reliably under the rigors of the space environment, temperature extremes, and high g loads. A trade was made to consider the advantages of an unregulated primary bus versus a regulated bus. The decision to use an unregulated bus was based on cost, weight, and the increase in load isolation achievable through the use of individual load regulators. Author

N74-27377*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 7: COMMUNICATION SUBSYSTEM STUDIES Final Report
D. M. Newlands et al Jul. 1973 129 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137494) Avail: NTIS HC $9.50 CSCL 22B

Communications subsystem tradeoffs were undertaken to establish a low cost and low weight design consistent with the mission requirements. Because of the weight constraint of the Thor/Delta launched configuration, minimum weight was emphasized in determining the Thor/Delta design. In contrast, because of the greatly relaxed weight constraint of the Atlas/Centaur launched configuration, minimum cost and off the shelf hardware were emphasized and the attendant weight penalities accepted. Communication subsystem hardware elements identified for study included probe and bus antennas (CM-6, CM-17), power amplifiers (CM-10), and the large probe transponder and small probe stable oscillator required for doppler tracking (CM-11, CM-16). In addition, particular hardware problems associated with the probe high temperature and high-g environment were investigated (CM-7). Author

N74-27378*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 8: COMMAND/DATA HANDLING SUBSYSTEMS STUDIES Final Report
D. D. Vesely et al Jul. 1973 203 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137495) Avail: NTIS HC $13.25 CSCL 22B

Study tasks for the command and data handling subsystems have been directed to: (1) determining ground data systems, (GDS) interfaces and deep space network (DSN) changes, if required, (2) defining subsystem requirements, (3) surveying existing hardware that could be used or modified to meet subsystem requirements, and (4) establishing a baseline design. Study of the existing GDS led to the conclusion that the Viking configuration GDS can be used with only minor changes required for the Pioneer Venus baseline. Those changes required are associated with providing a predetection recording capability used during probe entry and descent. Subsystem requirements were first formulated with sufficient latitude so that surveys of existing hardware could lead to low cost hardware which, in turn, could modify more narrowly defined subsystem requirements. Author

N74-27379*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 9: ATTITUDE CONTROL/MECHANISMS SUBSYSTEMS STUDIES Final Report
A. L. Neil Jul. 1973 247 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137496) Avail: NTIS HC $15.50 CSCL 22B

The Pioneer Venus mission study was conducted for a probe spacecraft and an orbiter spacecraft to be launched by either a Thor/Delta or an Atlas/Centaur launch vehicle. Both spacecraft are spin stabilized. The spin speed is controlled by ground commands to as low as 5 rpm for science instrument scanning on the orbiter and as high as 71 rpm for small probes released from the probe bus. A major objective in the design of the attitude control and mechanism subsystem (ACMS) was to provide, in the interest of costs, maximum commonality of the elements between the probe bus and orbiter spacecraft configurations. This design study was made considering the use of either launch vehicle. The basic functional requirements of the ACMS are derived from spin axis pointing and spin speed control requirements

implicit in the acquisition, cruise, encounter and orbital phases of the Pioneer Venus missions. Author

N74-27380*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 10: PROPULSION/ORBIT INSERTION SUB-SYSTEM STUDIES Final Report
B. J. Rosenstein et al Jul. 1973 94 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137497) Avail: NTIS HC $7.75 CSCL 22B

The Pioneer Venus orbiter and multiprobe missions require spacecraft maneuvers for successful accomplishment. This report presents the results of studies performed to define the propulsion subsystems required to perform those maneuvers. Primary goals were to define low mass subsystems capable of performing the required missions with a high degree of reliability for low cost. A review was performed of all applicable propellants and thruster types, as well as propellant management techniques. Based on this review, a liquid monopropellant hydrazine propulsion subsystem was selected for all multiprobe mission maneuvers, and for all orbiter mission maneuvers except orbit insertion. A pressure blowdown operating mode was selected using helium as the pressurizing gas. The forces associated with spacecraft rotations were used to control the liquid-gas interface and resulting propellant orientation within the tank. Author

N74-27381*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 11: LAUNCH VEHICLE UTILIZATION Final Report
R. J. Varga et al Jul. 1973 229 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137498) Avail: NTIS HC $14.50 CSCL 22B

A summary of the spacecraft descriptions; the probe bus, large probe, small probe, and orbiter is presented. The highlights on the designs of the Atlas/Centaur spacecraft as compared to the corresponding Thor/Delta spacecraft designs are contained. A comparison is made of the two Atlas/Centaur spacecraft for reference. The major differences are the replacement of the probes of the forward end of the probe bus with the mechanically despun antenna of the orbiter and the replacement of the bicone antenna on the aft end with the orbit insertion motor. The cross sections of the large and small probes are compared. The major features of each probe are described. The Thor/Delta and Atlas/Centaur designs for the probe bus and orbiter are analyzed. The usable spacecraft mass for the Atlas/Centaur is roughly twice that for the Thor/Delta if the Type I trajectory is assumed. It is somewhat less for the Type II trajectory in the designated launch years. This additional mass capability leads to cost savings in many areas which are described. Author

N74-27382*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 12: INTERNATIONAL COOPERATION Final Report
R. S. Kelly Jul. 1973 16 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137499) Avail: NTIS HC $4.00 CSCL 22B

A spectrum of plans has been prepared to illustrate the range of practical sharing possibilities available so as to assist Ames Research Center (ARC) and European Space Research Organization (ESRO) in selection of a program meeting mutual goals. Five plans are described showing increased participation by ESRO WITH ascending plan number. Each of these has sharing properties fulfilling particular requirements such as available ESRO budget level, extent of ESRO program responsobility, matching particular ESRO capability, and cost saving to ARC through sharing. All plans apply to orbiter sharing only. A sharing plan based on the model Plan 4 may offer the most attractive division of Pioneer Venus between ARC and ESRO. This plan allows ESRO to bear primary responsibility for the orbiter and to avoid an extensive financial burden. Savings to ARC are commensurate with ARC loss of program control. Duplication of effort is avoided by using orbiter subsystems that are common to the probe bus and orbiter. Author

N74-27383*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 13: PRELIMINARY DEVELOPMENT PLANS Final Report
M. S. Mixon Jul. 1973 22 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137500) Avail: NTIS HC $4.25 CSCL 22B

This Pioneer Venus Study final report describes the following baseline configurations: (1) Thor/Delta Spacecraft Baseline is the baseline presented at the midterm review on 26 February 1973, (2) Atlas/Centaur Spacecraft Baseline is the baseline resulting from studies conducted since the midterm, but prior to receipt of the NASA execution phase RFP, and subsequent to decisions to launch both the multiprobe and orbiter missions in 1978 and use the Atlas/Centaur launch vehicle, and (3) Atlas/Centaur Spacecraft Midterm Baseline is the baseline presented at the 26 February 1973 review and is only used in the launch vehicle utilization trade study. Author

N74-27384*# Hughes Aircraft Co., El Segundo, Calif.
SYSTEM DESIGN OF THE PIONEER VENUS SPACECRAFT. VOLUME 14: TEST PLANNING TRADES Final Report
C. D. Pedretti et al Jul. 1973 40 p refs 15 Vol.
(Contract NAS2-7250)
(NASA-CR-137501) Avail: NTIS HC $5.00 CSCL 22B

Pioneer Venus system test plans and trade studies which were first published as Study Tasks (References 1 through 5) are reviewed. The plan and trade studies are presented in a condensed form. Greater detail may be found in the referenced study tasks if desired. All significant conclusions and plan outlines of the original studies are, presented. Author

N74-27385*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF INVESTIGATIONS (OA20C) ON AN 0.015-SCALE CONFIGURATION 140A/B SPACE SHUTTLE VEHICLE ORBITER MODEL (49-0) IN THE NASA/LANGLEY RESEARCH CENTER UNITARY PLAN WIND TUNNEL
M. E. Nichols (Rockwell Intern. Corp., Downey, Calif.) Apr. 1974 188 p
(Contract NAS9-13247)
(NASA-CR-134097; DMS-DR-2147) Avail: NTIS HC $12.50 CSCL 22B

Data obtained from the wind tunnel tests of a scale model of the space shuttle orbiter configuration 140 A/B are presented. The test was conducted at Mach numbers of 2.5, 3.9, and 4.6 with Reynolds numbers from 1.25 million per foot to 5.0 million per foot. Various control surface settings were used ranging from an angle of attack range from minus 4 to plus 42 degrees at zero angle of yaw. Longitudinal stability and control characteristics of the space shuttle configuration were analyzed. Author

N74-27386*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA63 AND IA29 ON AN 0.015 SCALE MODEL OF THE SPACE SHUTTLE CONFIGURATION 140 A/B IN THE NASA/ARC 6- BY 6-FOOT TRANSONIC WIND TUNNEL, VOLUME 1
R. H. Spangler (Rockwell Intern.) and D. E. Thornton (Rockwell Intern.) Apr. 1974 599 p refs 3 Vol.
(Contract NAS9-13247)
(NASA-CR-134095; DMS-DR-2077-Vol-1) Avail: NTIS HC $33.00 CSCL 22B

Tests were conducted in the NASA/ARC 6- by 6-foot transonic wind tunnel from September 12 to September 28, 1973 on an 0.015-scale model of the space shuttle configuration 140 A/B. Surface pressure data were obtained for the orbiter for both launch and entry configuration at Mach numbers from 0.6 to 2.0. The surface pressures were obtained in the vicinity of the cargo bay door hinge and parting lines, the side of the fuselage at the crew compartment and below the OMS pods at the aft compartment. Data were obtained at angles of attack and sideslip consistent with the expected divergencies along the nominal trajectory. These tests were first in a series of tests supporting the orbiter venting analysis. The series will include tests in three facilities covering a total Mach number range from 0.6 to 10.4. Author

N74-27387*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA63 AND IA29 ON AN 0.015 SCALE MODEL OF THE SPACE SHUTTLE CONFIGURATION 140 A/B IN THE NASA/ARC 6- BY 6-FOOT TRANSONIC

WIND TUNNEL, VOLUME 2
R. H. Spangler (Rockwell Intern.) and D. E. Thornton (Rockwell Intern.) Apr. 1974 1076 p refs 3 Vol.
(Contract NAS9-13247)
(NASA-CR-134099; DMS-DR-2077-Vol-2) Avail: NTIS HC $57.00 CSCL 22B
For abstract, see N74-27386.

N74-27388*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA63 AND IA29 ON AN 0.015 SCALE MODEL OF THE SPACE SHUTTLE CONFIGURATION 140 A/B IN THE NASA/ARC 6- BY 6-FOOT TRANSONIC WIND TUNNEL, VOLUME 3
R. H. Spangler (Rockwell Intern.) and D. E. Thornton (Rockwell Intern.) Apr. 1974 592 p refs 3 Vol.
(Contract NAS9-13247)
(NASA-CR-134100; DMS-DR-2077-Vol-3) Avail: NTIS HC $32.75 CSCL 22B
For abstract, see N74-27386.

N74-27389*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS (OA64 AND IA35) OF AN 0.015-SCALE MODEL (36-OTS) OF THE SPACE SHUTTLE CONFIGURATION 140A/B IN THE NASA/LARC UNITARY PLAN WIND TUNNEL
D. E. Thornton (Rockwell Intern.) and R. H. Spangler (Rockwell Intern.) Apr. 1974 598 p refs
(Contract NAS9-13247)
(NASA-CR-134084; DMS-DR-2108) Avail: NTIS HC $33.00 CSCL 22B

Supersonic aerodynamic tests were conducted in the NASA/LaRC Unitary Plan Wind Tunnel on a 0.015-scale model of the Space Shuttle Vehicle 4 configuration. Surface pressure data were obtained for both the launch (test IA35) and entry (test OA64) configurations at Mach numbers from 2.5 to 4.5. The surface pressure was measured in the vicinity of the cargo bay door hinge and parting lines and on the side of the fuselage at the crew compartment and below the OMS pods at the aft compartment. Data were obtained for angles of attack and sideslip consistent with the expected excursions about the nominal trajectory values at the test Mach numbers. These tests were a part of a test series supporting the orbiter venting analysis over a Mach number range from 0.6 to 10.4 Author

N74-27390*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE INTERACTION OF SPACECRAFT HIGH VOLTAGE POWER SYSTEMS WITH THE SPACE PLASMA ENVIRONMENT
Stanley Domitz and Norman T. Grier 1974 10 p refs Presented at Power Electron. Specialists Conf., Murray Hill, N. J., 10-12 Jun. 1974; sponsored by IEEE
(NASA-TM-X-71554; E-7974) Avail: NTIS HC $3.00 CSCL 22B

The development of spacecraft with electrical loads that require high voltage power is discussed. The high voltage solar array has been considered for supplying d.c. power directly to high voltage loads such as ion thrusters and communication tubes without intermediate power processing. Space power stations for transferring solar power to earth are being studied in the 40 kilovolt, multikilowatt regime. Analytical and experimental studies have determined that with the advent of high voltage power, new problems will arise through the interaction of the high voltage surfaces with the charged particle environment of space. The interactive environment has been identified and duplicated to some extent in simulation facilities at NASA-Lewis Research Center and at several contractor locations. Author

N74-27391*# Linguistic Systems, Inc., Cambridge, Mass.
ARTIFICIAL EARTH SATELLITES INVESTIGATE THE ENVIRONMENT
Yuri Y. Vasilevich Zonov Washington NASA Apr. 1974 22 p refs Transl. into ENGLISH from Priroda (Moscow), no. 12, Dec. 1973 p 2-9
(Contract NASw-2482)
(NASA-TT-F-15409) Avail: NTIS HC $4.25 CSCL 22B

The uses of artificial satellites for studying the processes in the spread of industrial wastes in nature and for achieving inspections for compliance with legal requirements are discussed. The development of sensors for detecting gaseous emissions from industrial processes is examined. The use of satellite-borne photography for determining the nature of ocean currents and the diffusion processes of turbid waters is examined. Photographic samples of various geographical regions to show pollution detection are included. Author

N74-27392# Sandia Labs., Albuquerque, N.Mex.
THERMAL ANALYSIS FOR INSERTION OF ANTENNA WINDOW IN THE NOSETIP OF AN AIR-TO-GROUND MISSILE
J. H. Smith and W. H. McCulloch Jan. 1974 17 p refs
(Contract AT(29-1)-789)
(SLA-73-1021) Avail: NTIS HC $3.00

Pyrolysis and subsequent formation of a carbonaceous char layer on the phenolic refrasil nosetip of an air-to-ground missile occur routinely during certain required trajectories. In order to adequately flight-test this missile, a nosetip telementry antenna must be added. However, the conductive char layer is highly attenuating to the electromagnetic radiation. The analyses entailed in the nosetip re-design for insertion of a noncharring antenna window while preserving the original body contour are discussed. Various portions of the analyses deal with convective heating from the boundary layer, conduction into the nosetip, radiation to space, and decomposition of the phenolic refrasil.
Author (NSA)

N74-27393# European Space Research Organization, Paris (France).
THE INFLUENCE OF FLIGHT MECHANICAL PARAMETERS ON THE ASCENT TRAJECTORY OF A HORIZONTALLY STARTING SPACE SHUTTLE WITH TRAJECTORY AND STAGING OPTIMIZATION
Gen-Chain Shau (DFVLR, Oberpfaffenhofen, West Ger.) May 1974 159 p refs Transl. into ENGLISH of Der Einfluss Flugmechanischer Parameter auf die Aufstiegsbahn von Horizontalstartenden Raumtransportern bei Gleichzeitiger Bahn-/Stufungsoptimierung, DLR-FB-73-86, DFVLR, 3 Jul. 1973
(ESRO-TT-50; DLR-FB-73-86) Avail: NTIS HC $11.00; DFVLR, Porz, West Ger. 51.40 DM

The influence of ascent trajectory boundary conditions of a space shuttle with horizontal take off and its vehicle parameters on the payload are investigated. The results obtained by numerical solution of the trajectory and staging optimization problem are discussed. The variational problem is formulated as a discontinuous problem of the calculus of variations. Optimality conditions for the jump points are derived using Hilbert's invariant integral and Hamilton's formulas. Hamilton's characteristic function is discussed. A modified version of the shooting method is employed for solving the boundary value problem. Author (ESRO)

N74-27394# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ANALYTICAL DESIGN OF STABILITY AUGMENTATION AND GUIDANCE LOOPS FOR A BEAM RIDER GUIDED PROJECTILE
Orrin C. Kaste Mar. 1974 60 p refs
(DA Proj. 1G5-62603-DF-06)
(AD-775799; BRL-MR-2355) Avail: NTIS CSCL 19/5

Design analyses were performed for the stability augmentation and guidance loops for a single axis of a 105mm beam rider guided projectile. Five flight conditions corresponding to various Mach numbers in the range from 1.5 to 4.0 were considered. Root locus techniques were used to select constant gains to provide good damping and good response to guidance commands over the Mach range considered. Transient responses to step, ramp, and parabolic inputs were calculated to illustrate the dynamic behavior characteristics of the design evolved. The influence of parameter changes on characteristic root locations was investigated. Author (GRA)

N74-27395# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
TRANSTAGE ACS ATTITUDE CONTROL SYSTEM VALVE STORAGE TESTS Final Report, Mar. 1972 - Sep. 1973
John E. Branigan and Garrett J. Gunderson Feb. 1974 52 p
(AF Proj. 624A)

(AD-777284; AFRPL-TR-74-02) Avail: NTIS CSCL 13/1

The Attitude Control Systems (ACS) for the Transtage vehicle were procured in quantities sufficient to satisfy the usage rate for a number of years. The components for the system were stored on the shelf until needed. The Air Force Space and Missile Systems Organization (SAMSO) requested that the Air Force Rocket Propulsion Laboratory (AFRPL) concurrently store a number of similar valves for a period of five years, with annual performance tests which could be used to determine the effects of shelf storage and to provide confidence in the performance of the valves. The objective of the test program was to provide SAMSO with test data on the effects of shelf storage on the Transtage ACS Valve performance. GRA

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-27396 Florida Univ., Gainesville.
INELASTIC WAVE PROPAGATION UNDER COMBINED STRESS STATES Ph.D. Thesis
Charles Daniel Myers 1973 248 p
Avail: Univ. Microfilms Order No. 74-10072

The effects of radial inertia and material strain-rate dependence on the propagation of inelastic waves of combined stress along a thin-walled tube were investigated. A general quasilinear constitutive equation for multiaxial stress (and strain) states was introduced. The equations of motion and the strain-displacement equations, along with the constitutive equations, were written to form a set of nine simultaneous hyperbolic, quasilinear, partial differential equations. This set of equations was reduced to a set of six equations which was then used to determine the expressions for the characteristic lines and the equations along the characteristic lines. For combined torsional and longitudinal loading, two distinct wave speeds were found. The values of these two wave speeds were found as functions of the state of stress. Including radial inertia effects in the formulation of the problem was shown to significantly increase the wave speeds for a given stress state. Dissert. Abstr.

N74-27397* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THRUST-ISOLATING MOUNTING Patent
Dallas G. Wetzler, inventor (to NASA) (McDonnell-Douglas Corp., Huntington Beach, Calif.) Issued 4 Jun. 1974 11 p Filed 21 Mar. 1973 Sponsored by NASA
(NASA-Case-MFS-21680-1; NASA-Case-MFS-21681-1; US-Patent-3,814,350; US-Patent-Appl-SN-343607; US-Patent-Class-244-1SS; US-Patent-Class-248-16; US-Patent-Class-248-23) Avail: US Patent Office CSCL 20K

A supporting frame for a load, such as one or more telescopes, is isolated from all multi-gravitational forces, which will be developed within that load as that load is propelled into space, by using a shroud to fully and solidly hold that load until that load has been propelled into space. Thereafter, that shroud will be jettisoned; and then supports which are on, and which are movable with, that load will have surfaces thereon moved into supporting engagement with complementary surfaces on that supporting frame to enable that supporting frame and those supports to fully and solidly hold that load.
Official Gazette of the U.S. Patent Office

N74-27398 Yale Univ., New Haven, Conn.
INCREMENTAL WAVE PROPAGATION IN PLASTICALLY PRESTRAINED ALUMINUM 1100-0 AND PRESTRAINED NYLON Ph.D. Thesis
Ralph M. Perlman 1973 103 p
Avail: Univ. Microfilms Order No. 74-12490

Experiments were performed in which compressive incremental stress pulses having a wide range of amplitudes and strain rates were superposed on quasi-statically prestrained rods made of 1100-0 aluminum and nylon. The aluminum was prestrained into its plastic range while the nylon was kept within its linear range. The experiments were designed to permit detailed study of the pulse shape at amplitudes as low as 50 psi. The effects of the incremental strain rate and amplitude, and the prestrain level in the aluminum were explicitly determined with respect to such factors as: (1) the maximum amplitude of the leading edge of the pulse which will propagate elastically, (2) subsequent post-yield behavior of the associated incremental pulse, and (3) attenuation of the elastic front of the increment. In the nylon only the effect of the prestrain on initial behavior of the increment was considered. For aluminum, the observed behavior is related to dislocation dynamics while an analytical treatment is given for nylon. Dissert. Abstr.

N74-27399*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
THREE-DIMENSIONAL CRACK PROBLEMS Final Report
R. J. Hartranft and G. C. Shin Jan. 1974 5 p refs
(Grant NGR-39-007-066)
(NASA-CR-138652) Avail: NTIS HC $4.00 CSCL 20K

Methods for solving three dimensional crack problems are discussed. The stress intensity factor for the case of uniform pressure on the surface crack is analysis. An analysis of concentrated forces acting on the crack faces parallel to the crack front of a half-plane crack was made. Two dimensional calculations were made using the exact solution for the stress field around an elliptical hole in a uniformly stretched plate. The strain energy density was computed in the neighborhood of the ends of narrow, but sharp, ellipses. Author

N74-27400*# Lehigh Univ., Bethlehem, Pa.
THE USE OF COD AND PLASTIC INSTABILITY IN CRACK PROPAGATION AND ARREST IN SHELLS
F. Erdogan and M. Ratwani (Northrop Corp., Hawthorne, Calif.) Jan. 1974 23 p refs
(Grant NGR-39-007-011)
(NASA-CR-138625; Paper-6) Avail: NTIS HC $4.25 CSCL 20K

The initiation, growth, and possible arrest of fracture in cylindrical shells containing initial defects are dealt with. For those defects which may be approximated by a part-through semi-elliptic surface crack which is sufficiently shallow so that part of the net ligament in the plane of the crack is still elastic, the existing flat plate solution is modified to take into account the shell curvature effect as well as the effect of the thickness and the small scale plastic deformations. The problem of large defects is then considered under the assumptions that the defect may be approximated by a relatively deep meridional part-through surface crack and the net ligament through the shell wall is fully yielded. The results given are based on an 8th order bending theory of shallow shells using a conventional plastic strip model to account for the plastic deformations around the crack border. Author

N74-27401*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
A PENNY-SHAPED CRACK IN A FILAMENT REINFORCED MATRIX. 1: THE FILAMENT MODEL
F. Erdogan and A. H. Pacella Jul. 1973 27 p refs
(Grant NGR-39-007-011; NSF GK-11977)
(NASA-CR-138626; TR-73-13; IFSM-73-44) Avail: NTIS HC $4.50 CSCL 20K

The electrostatic problem of a penny-shaped crack in an elastic matrix which reinforced by filaments or fibers perpendicular to the plane of the crack was studied. The elastic filament model was developed for application to evaluation studies of the stress intensity factor along the periphery of the crack, the stresses in the filaments or fibers, and the interface shear between the matrix and the filaments or fibers. The requirements expected of the model are a sufficiently accurate representation of the filament and applicability to the interaction problems involving a cracked elastic continuum with multi-filament reinforcements. The technique for developing the model and numerical examples of it are shown. Author

N74-27402*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
A PENNY SHAPED CRACK IN A FILAMENT-REINFORCED

MATRIX. 2: THE CRACK PROBLEM
A. H. Pacella and F. Erdogan Jul. 1973 17 p refs
(Grants NGR-39-007-011; NSF GK-11977)
(NASA-CR-138677; TR-73-14; IFSM-73-45) Avail: NTIS HC $4.00 CSCL 20K

The elastostatic interaction problem between a penny-shaped crack and a slender inclusion or filament in an elastic matrix was formulated. For a single filament as well as multiple indentical filaments located symmetrically around the crack the problem is shown to reduce to a singular integral equation. The solution of the problem is obtained for various geometries and filament-to-matrix stiffness ratios, and the results relating to the angular variation of the stress intensity factor and the maximum filament stress are presented. Author

N74-27403*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
TRANSVERSE CRACKS IN A STRIP WITH REINFORCED SURFACES
S. Krenk and M. Bakioglu Nov. 1973 14 p refs
(Grant NGR-39-007-011)
(NASA-CR-138620; IFSM-73-51) Avail: NTIS HC $4.00 CSCL 20K

The symmetrical problem of two transverse cracks in an elastic strip with reinforced surfaces is formulated in terms of a singular integral equation. The special cases of one central crack or two edge cracks are discussed. Numerical methods for solving the problems with internal cracks are outlined and stress intensity factors are presented for various geometrics and degrees of surface reinforcement. Author

N74-27404*# Boeing Commercial Airplane Co., Seattle, Wash.
ELASTIC STABILITY OF LAMINATED, FLAT AND CURVED, LONG RECTANGULAR PLATES SUBJECTED TO COMBINED INPLANE LOADS Final Report
A. V. Viswanathan, M. Tamekuni, and L. L. Baker Washington NASA Jun. 1974 68 p refs
(Contract NAS1-11879)
(NASA-CR-2330; D6-60227) Avail: NTIS HC $3.75 CSCL 20K

A method is presented to predict theoretical buckling loads of long, rectangular flat and curved laminated plates with arbitrary orientation of orthotropic axes each lamina. The plate is subjected to combined inplane normal and shear loads. Arbitrary boundary conditions may be stipulated along the longitudinal sides of the plate. In the absence of inplane shear loads and extensional-shear coupling, the analysis is also applicable to finite length plates. Numerical results are presented for curved laminated composite plates with boundary conditions and subjected to various loadings. These results indicate some of the complexities involved in the numerical solution of the analysis for general laminates. The results also show that the reduced bending stiffness approximation when applied to buckling problems could lead to considerable error in some cases and therefore must be used with caution. Author

N74-27405*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC FLUTTER STUDY OF A 50.5 DEG CROPPED-DELTA WING WITH TWO REARWARD-MOUNTED NACELLES
Maynard C. Sandford, Charles L. Ruhlin, and Irving Abel Washington Jun. 1974 31 p refs
(NASA-TN-D-7544; L-9348) Avail: NTIS HC $3.25 CSCL 01C

Transonic flutter characteristics of three geometrically similar delta-wing models were experimentally determined in the Langley transonic dynamics tunnel at Mach numbers from about 0.6 to 1.2. The models were designed to be simplified versions of an early supersonic transport wing design. The model was an aspect-ratio-1.28 cropped-delta wing with a leadingedge sweep of 50.5 deg. The flutter characteristics obtained for this wing configuration indicated a minimum flutter-speed index near a Mach number of 0.92 and a transonic compressibility dip amounting to about a 27-percent decrease in the flutter-speed index relative to the value at a Mach number of 0.6. Analytical studies were performed for one wing model at Mach numbers of 0.6, 0.7, 0.8, and 0.9 by using both doublet-lattice and lifting-surface (kernel-function) unsteady aerodynamic theory. A comparison of the analytical and experimental flutter results showed good agreement at all Mach numbers investigated. Author

N74-27406*# Ohio State Univ., Columbus.
APPLICATION OF HAMILTON'S LAW OF VARYING ACTION
Cecil D. Bailey [1973] 39 p refs
(Grant NGR-36-008-197)
(NASA-CR-138207) Avail: NTIS HC $5.00 CSCL 20K

The application of Hamilton's Law to the direct solution of nonstationary as well as stationary problems in mechanics of solids is discussed. Solutions are demonstrated for conservative and nonconservative, stationary and/or nonstationary particle motion. Mathematical models are developed to establish the relationships of the parameters. Author

N74-27407*# California Univ., Los Angeles. School of Engineering and Applied Science.
APPLICATION OF OPTIMALITY CRITERIA IN STRUCTURAL SYNTHESIS
Kenji Terai Jun. 1974 128 p refs
(Grant NGR-05-007-337)
(NASA-CR-138612; UCLA-ENG-7446) Avail: NTIS HC $9.50 CSCL 20K

The rational use of optimality criteria was investigated for a class of structural synthesis problems where materials, configuration and applied load conditions are specified, and the minimum weight design is to be determined. The potential of hybrid methods of structural optimization for dealing with relatively large design problems involving practical complexity was explored. The reduced basis concept in design space was used to decrease the number of generalized design variables dealt with by the mathematical programming algorithm. Optimality criteria methods for obtaining design vectors associated with displacement, system buckling and natural frequency constraints are presented. A stress ratio method was used to generate a basis design vector representing the stress constraints. The finite element displacement method was used as the basic structural analysis tool. Results for several examples of truss systems subject to stress, displacement and minimum size constraints are presented. An assessment of these results indicates the effectiveness of the hybrid method developed. Author

N74-27408*# Martin Marietta Corp., Denver, Colo.
DESIGN, FABRICATION, AND TEST OF LIGHTWEIGHT SHELL STRUCTURE Quarterly Progress Report, 1 Mar. - 31 May 1974
31 May 1974 43 p
(Contract NAS8-29979)
(NASA-CR-120232; QPR-1) Avail: NTIS HC $5.25 CSCL 20K

A cylindrical shell skirt structure was subjected to a design and analysis study using a wide variety of structural materials and concepts. The design loading, axial compression, and torsion is representative of that expected on a typical space tug skirt section. Structural concepts evaluated included honeycomb sandwich, truss, isogrid, and skin/stringer/frame. The materials considered included a wide variety of structural metals as well as glass, graphite, and boron-reinforced composites. Honeycomb sandwich with aluminum faceskins, honeycomb sandwich with graphite/epoxy faceskins, and aluminum truss with fiberglass meteoroid protection layers were the designs selected for further evaluation. Procurement of materials required for fabrication is reported and the structural test plan and fabrication drawings are included. Construction of the graphite/epoxy faceskins, chem mill of the aluminum faceskins, chem mill of aluminum truss components, and fabrication of the graphite/epoxy honeycomb sandwich development panel is also reported. Author

N74-27409# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics.
EVALUATION OF NUMERICAL TIME INTEGRATION METHODS AS APPLIED TO ELASTIC-PLASTIC DYNAMIC PROBLEMS INVOLVING WAVE PROPAGATION
Hyman Garnet and Harry Armen Mar. 1974 47 p refs
(RE-475) Avail: NTIS HC $5.50

Several of the more commonly used time integration methods for problems in structural dynamics were applied to obtain the elastoplastic dynamic response of a finite element bar assemblage. Two equivalent problems, representing a first order simulation of a crash that might be suffered by a surface or an aircraft vehicle, were selected to test the various methods. These problems are as follows: (1) an elastic-plastic bar is fixed at one end and subject to a step pulse at the other end; and (2) a bar free at both ends travels with uniform velocity and crashes into a rigid barrier. A stress wave was propogated from the end of the bar experiencing impact in both cases. These problems represent a severe tests of any time integration procedure, since they require the need to represent the propagation of steep elastic and plastic wave fronts. This essential requirement is met by the version of the modified Adams method presented. Author

N74-27410# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics.
PLASTIC ANALYSIS
H. Armen, Jr. May 1974 44 p refs Submitted for publication
(RE-476J) Avail: NTIS HC $5.25

An overview and evaluation of available general purpose plasticity programs and some theoretical considerations necessary for the treatment of plasticity within the framework of a comprehensive structural analysis program are presented. Definitions of several basic concepts are included to provide a user of these programs with the necessary ingredients for an understanding of the limitations of the applied numerical procedures. Accordingly, this information should be of value in an assessment of currently available software. Descriptions of the capabilities of several comprehensive programs are provided. This list will facilitate a preliminary assessment of the available options open to a potential user. Author

N74-27411*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USER'S GUIDE FOR ANALYSIS OF FINITE ELASTOPLASTIC DEFORMATION: THE FIPDEF AND FIPAX PROGRAMS FOR THE CDC 6600
Jon R. Osias Washington Jun. 1974 74 p refs
(NASA-TM-X-2998; E-7610) Avail: NTIS HC $3.75 CSCL 20K

Computer programs are presented which provide incremental finite-element analysis capability for problems of quasi-static, finite, elastoplastic deformation in two spatial dimensions (plane strain, plane stress, axisymmetric). Monotonic or cyclic loading of isotropic hardening materials is considered. The only restriction on the form of the stress-strain curve is that the rate of work hardening exceed some small positive value. The user's guide assumes familiarity with both finite-element analysis and FORTRAN IV programming for the CDC 6600. Sufficient information is provided to support problem solving ultization of the programs. Author

N74-27412*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GRAPHITE-POLYIMIDE COMPOSITE FOR APPLICATION TO AIRCRAFT ENGINES
Morgan P. Hanson and Christos C. Chamis Washington Jun. 1974 27 p refs
(NASA-TN-D-7698; E-7700) Avail: NTIS HC $3.25 CSCL 11D

A combined experimental and theoretical investigation was performed in order to (1) demonstrate that high quality angleplied laminates can be made from HT-S/PMR-RI (PMR in situ polymerization of monomeric reactants), (2) characterize the PMR-PI material and to determine the HT-S unidirectional composite properties required for composite micro and macromechanics and laminate analyses, and (3) select HT-S/PMR-PI laminate configurations to meet the general design requirements for high-tip-speed compressor blades. The results of the investigation showed that HT-S/PMR laminate configurations can be fabricated which satisfy the high-tip-speed compressor blade design requirements when operating within the temperature capability of the polymide matrix. Author

N74-27413*# Avco Corp., Lowell, Mass. Systems Div.
DESIGN AND FABRICATION OF A BORON REINFORCED INTERTANK SKIRT
Jim Henshaw, Paul A. Roy, and Paul Pylypetz [1974] 121 p refs
(Contract NAS1-9938)
(NASA-CR-132448) Avail: NTIS HC $9.25 CSCL 20K

Analytical and experimental studies were performed to evaluate the structural efficiency of a boron reinforced shell, where the medium of reinforcement consists of hollow aluminum extrusions infiltrated with boron epoxy. Studies were completed for the design of a one-half scale minimum weight shell using boron reinforced stringers and boron reinforced rings. Parametric and iterative studies were completed for the design of minimum weight stringers, rings, shells without rings and shells with rings. Computer studies were completed for the final evaluation of a minimum weight shell using highly buckled minimum gage skin. The detail design is described of a practical minimum weight test shell which demonstrates a weight savings of 30% as compared to an all aluminum longitudinal stiffened shell. Sub-element tests were conducted on representative segments of the compression surface at maximum stress and also on segments of the load transfer joint. A 10 foot long, 77 inch diameter shell was fabricated from the design and delivered for further testing. Author

N74-27414# Oxford Univ. (England). Dept. of Engineering Science.
ON THE TRANSMISSION OF NON-UNIFORM TORSION THROUGH JOINTS
J. D. Renton 1974 14 p refs
(Rept-1086/74) Avail: NTIS HC $4.00

The concept of nonuniform torsion is summarized and some ideas concerning its transmission through rigid joints are discussed. It is shown that the reverse of the previously assumed behavior can occur if the members are rigidly connected in a different way. A matrix form and suitable torsional functions are proposed for dealing with such problems in a formal manner suitable for computer analysis. Author (ESRO)

N74-27415# California Univ., Los Angeles. School of Engineering and Applied Science.
COMPARISON OF VARIOUS METHODS OF MEASURING K SUB Ic ON SMALL PRECRACKED BEND SPECIMENS THAT FRACTURE AFTER GENERAL YIELD
J. N. Robinson and A. S. Tetelman Jan. 1974 44 p refs
(Contract DAHC04-69-C-0008)
(AD-777009; UCLA-ENG-7409; AROD-8016-12-MC; TR-13) Avail: NTIS CSCL 11/6

An experimental investigation into the measurement of fracture toughness on small precracked bend specimens after general yield is described. Six parameters are compared on the basis of their accuracy and utility in predicting KIc. The parameters are: (1) the on-load crack tip opening displacement, COD, (2) the lateral (notch root, crack tip) contraction, NRC, (3) the angle of bend, (4) the stretch zone, (5) the J integral, and (6) the equivalent energy. The results show that, from the standpoint of accuracy and of ease of measurement, the plane strain COD at fracture initiation, (COD)Ic, is the most useful parameter for measuring KIc on small specimens that fracture after general yield. Author (GRA)

N74-27416# Army Foreign Science and Technology Center, Charlottesville, Va.
APPROXIMATE CALCULATION OF CRITICAL STRESSES
L. I. Verein 3 Dec. 1973 8 p refs Transl. into ENGLISH from Mashinostr. (Kiev), no. 3, 1971 p 18-21
(AD-776560; FSTC-HT-23-2068-72) Avail: NTIS CSCL 20/12

A relationship is derived for the approximate determination of critical stresses of longitudinally compressed Textolite rods, with the principal fiber-filler direction along the length of the rod and with swivel bearing ends. The results of calculation by three approximate methods are presented. Graphical functions are plotted for convenience. D.L.G.

N74-27417# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF THE METHODS OF THE THEORY OF RELIABILITY TO ANALYSIS OF STRUCTURES
V. V. Bolotin 4 Feb. 1974 360 p refs Transl. into ENGLISH from the Monograph "Primenenie Metodov Teorii Veroyuatnostei i Teorii Nadezhnosti v Raschetakh Sooruzhenii" 1971 p 1-255
(AD-776115; FTD-MT-24-771-73) Avail: NTIS CSCL 20/11

This book systematically discusses statistical dynamics and reliability theory as applied to structures. Methods of calculating the effect of static and dynamic loads of a random nature on structures are examined. Discussed is the theory of reliability, which is based on interpreting failure as a random departure from a permissible range in a property space. Methods of estimating reliability for multidimensional euclidean and functional property spaces are given. A number of examples are used to illustrate this discussion. GRA

N74-27418# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF USING THE METHOD OF FINITE ELEMENTS TO CONSTRUCT AN ALGORITHM FOR CALCULATING A THIN-WALLED REINFORCED SHELL OF AN EXTREMELY IRREGULAR NATURE AND ADAPTING THIS PROBLEM TO THE ELECTRONIC DIGITAL COMPUTER
Z. I. Burman 8 Mar. 1974 26 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 8, 1972 p 200-215
(AD-776892; FTD-HT-23-359-74) Avail: NTIS CSCL 20/11

Some of the features of the algorithm developed for calculating a thin-walled reinforced shell of irregular nature are discussed. The theoretical principles of solving the problem of the stressed-strained state of a thin-walled reinforced shell by the method of forces in a matrix form are considered and the problem is extended to the case of extremely irregular structures. The proposed algorithm formulas assure a minimal number of operational programs. D.L.G.

N74-27419# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PRINCIPLE OF DYNAMIC EQUIPOLLENCY AND THE LIMITATIONS OF THE INVERSE EIGENVALUE METHOD OF MECHANICAL ADMITTANCE ANALYSIS
Ronald L. Bagley 4 Mar. 1974 36 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-776797; TN-1974-17; ESD-TR-74-46) Avail: NTIS CSCL 20/11

Limitations on the practical application of the inverse eigenvalue method are discussed. The principle of dynamic equipollency, which is derived and related to the limitations of the inverse eigenvalue method, makes possible an efficient method of dealing with a structure having many degrees of freedom. It is also shown that moment-rotational velocity impedances can be generated experimentally using the principle of dynamic equipollency. Author (GRA)

N74-27420# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF PLATES (CHAPTER 2)
A. S. Volmir and I. G. Kildibekov 15 Mar. 1974 49 p refs Transl. into ENGLISH from Prochnost-Ustoichivost-Kolebaniya (USSR), v. 3, 1968 p 91-126
(AD-777289; FTD-HC-23-998-74) Avail: NTIS CSCL 20/11

A numerical analysis of the buckling strength of rectangular plates within elastic limits is presented. Mathematical models are developed for computing critical stresses and flexure energy. Graphs and tables of data are included to show the values of the coefficients used in the mathematical models for plates of different dimensions. The study is extended to the performance of rectangular plates beyond elastic limits. Mathematical models and theoretical considerations are developed for this latter condition. Solutions to problems of a reinforced plate are shown to illustrate the different approach to the analysis. Author

N74-27421# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMIC STABILITY OF CYLINDRICAL SHELLS UNDER STEP LOADING Interim Report
Yukio Stephen Tamura Jun. 1973 111 p refs
(Grant AF-AFOSR-2447-73; AF Proj. 6813; AF Proj. 9782)
(AD-777291; GALCIT-SM-73-5; AFOSR-74-0460TR) Avail: NTIS CSCL 20/11

A study has been made to determine the dynamic stability of an imperfect circular cylindrical shell subject to a step loading in the axial direction. In the analysis, the radial displacement of the shell is approximated by a finite degree of freedom system. To assure that the created model is proper, its static buckling behavior was studied. It was found that the model gives the proper imperfection sensitivity behavior. (Modified author abstract) GRA

N74-27422# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
FATIGUE CRACK INITIATION AS A FUNCTION OF TEMPERATURE AND STRAIN RATE
S. J. Stadnick Mar. 1974 47 p refs
(Contracts DAHC15-72-G-10; DAHC15-73-G-7; ARPA Order 2169)
(AD-777739; T/AM-382; UILU-ENG-74-6004) Avail: NTIS CSCL 11/6

Thirty-four specimens of pure (0.999-) aluminum were cyclically strained under a variety of plastic strain ranges, plastic strain rates and temperatures in an atmosphere of dry nitrogen. Stable cyclic stress strain data was recorded for a variety of plastic strain rates and temperatures. A time-temperature parameter method of analysis was found to give an adequate representation of the stable cyclid stress-strain relationships for the conditions tested. The specimen surface was observed with both light and electron microscopes to determine when and where fatigue crack initiation occurred. Electropolishing was used to discover the depth and relationship of the crack to slip bands and grain boundaries. The results showed that three forms of crack initiation were present. At low temperatures, grain boundary splitting was common. At room temperature, prominent slip band initiation was prevalent, and at high temperature vacancy coalescence at the grain boundary was the major source of crack initiation. The number of cycles to initiate a crack 0.002 deep at a given strain range was found to be independent of the nature of the crack and both test temperature and plastic strain rate. Author (GRA)

N74-27423# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STABILITY OF SPHERICAL SHELLS UNDER THE COMBINED ACTION OF AN EXTERNAL PRESSURE AND LOCAL AXISYMMETRIC LOADS
V. I. Myachenkov 14 Nov. 1973 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Tverdogo Tela (Moscow), Nov. - Dec. 1970 p 133-138
(AD-777409; NISC-Trans-3473) Avail: NTIS CSCL 20/11

The results of investigations of the stability of isotropic elastic spherical shells under the combined action of axial compression and axisymmetric local loads are presented. The investigation is based on the analysis of a solution of equations of neutral equilibrium of gently sloping spherical shells arrived at by means of the method of finite differences. As in the case of cylindrical shells, the curves of interaction in all problems examined are concave. GRA

N74-27424# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STABILITY OF AN AXIALLY COMPRESSED CIRCULAR CYLINDRICAL SHELL WITH EDGES STIFFENED BY ELASTIC RINGS
V. V. Kabanov 14 Nov. 1973 11 p refs Transl. into ENGLISH from Mekhan. Tverdogo Tela (USSR), May/Jun. 1970 p 50-56
(AD-777425; NISC-Trans-3467) Avail: NTIS CSCL 20/11

The subcritical state of the shell was determined on the basis of the nonlinear theory of the boundary effect. The elasticity of the rings was taken into account in both the subcritical and disturbed states. A closed solution was obtained in the case of axisymmetric buckling. The symmetric and skew-symmetric forms of lengthwise buckling were investigated. The effect of ring rigidity on the amount of critical stress and the form of buckling were analyzed. Author

N74-26459 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE LIFE OF STRUCTURAL COMPONENTS UNDER

RANDOM LOADING
E. Gassner *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 35 p refs (For availability see N74-26458 16-02) (LBF-FB-107/1973)

N74-26466 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
EFFECT OF MEAN STRESS ON CRACK PROPAGATION UNDER RANDOM LOADING
H. Nowack and B. Mukherjee *In* RAE Fail-safe Aircraft Struct., Vol. 1 Mar. 1974 29 p refs (For availability see N74-26458 16-02)
Avail: NTIS

N74-26470 United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
FATIGUE AND FRACTURE CONSIDERATIONS IN CRITICAL TITANIUM COMPONENTS
M. J. Salkind *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 12 p refs (For availability see N74-26468 16-02)

N74-26471 Oklahoma City Air Materiel Area, Tinker AFB, Okla.
EFFECT OF PROOF LOAD APPLICATION ON FATIGUE TEST RESULTS
J. Bell and J. B. Dempster (Boeing Co., Wichita, Kans.) *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 25 p refs (For availability see N74-26468 16-02)

N74-26472 Federal Aircraft Establishment, Emmen (Switzerland).
RESIDUAL STRENGTH AT HIGH LOADING RATES OF FATIGUE CRACKED TEST SPECIMENS OF TWO ALUMINIUM ALLOYS AND SOME STEELS
J. Branger *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 84 p refs (For availability see N74-26468 16-02)

N74-26477 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
FULL-SCALE FATIGUE TESTING. A COMPARISON WITH SERVICE EXPERIENCE AND INTERPRETATION OF TEST RESULTS
H. J. Zocher *In* RAE Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 35 p refs (For availability see N74-26468 16-02)

N74-26478 Royal Aircraft Establishment, Farnborough (England).
FATIGUE IN CARBON FIBRE REINFORCED PLASTIC STRUCTURES: A REVIEW OF THE PROBLEMS
A. W. Cardrick *In its* Fail-safe Aircraft Struct., Vol. 2 Mar. 1974 28 p refs (For availability see N74-26468 16-02)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-27425* National Aeronautics and Space Administration. Pasadena Office, Calif.
OPTICALLY DETONATED EXPLOSIVE DEVICE Patent
Lien C. Yang (JPL) and Vincent J. Menichelli, inventors (to NASA) (JPL) Issued 28 May 1974 5 p Filed 3 Aug. 1972 Sponsored by NASA
(NASA-Case-NPO-11743-1; US-Patent-3,812,783; US-Patent-Appl-SN-277904; US-Patent-Class-102-70-2R; US-Patent-Class-102-28EB; US-Patent-Class-102-70.2A) Avail: US Patent Office CSCL 19A

A technique and apparatus for optically detonating insensitive high explosives, is disclosed. An explosive device is formed by containing high explosive material in a house having a transparent window. A thin metallic film is provided on the interior surface of the window and maintained in contact with the high explosive. A laser pulse provided by a Q-switched laser is focussed on the window to vaporize the metallic film and thereby create a shock wave which detonates the high explosive. Explosive devices may be concurrently or sequentially detonated by employing a fiber optic bundle to transmit the laser pulse to each of the several individual explosive devices.
Official Gazette of the U.S. Patent Office

N74-27426 Wisconsin Univ., Madison.
A STUDY OF HEAT TRANSFER BY FREE CONVECTION TO SUPERCRITICAL HELIUM Ph.D. Thesis
Mohamed Ahmed Hilal 1973 214 p
Avail: Univ. Microfilms Order No. 74-9000

Cryogenic free convective heat transfer from a sphere to supercritical helium is reported. The free convective heat transfer coefficient was measured within the following region: 4.2 to 25 K and 3 to 35 atmospheres, which is the supercritical region. Measurements were made for sphere to helium temperature difference of 0.1 to 7 K. The sphere was suspended in a thick wall cylinder filled with helium. After the helium pressure and temperature in the container were adjusted to the desired values the heater in the sphere was turned on until a steady state was reached. Analytically it was possible to solve the boundary layer equations for a semi-infinite plane assuming uniform surface temperature and laminar conditions.
Dissert. Abstr.

N74-27427# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE THEORY OF THERMAL FLUCTUATIONS IN NONEQUILIBRIUM SYSTEMS
G. F. Efremov Mar. 1973 20 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorkiy), v. 15, no. 8, 1972 p 1207-1219
(NTC-74-11945; Rept-73-69) Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The association of thermal fluctuations in non-equilibrium systems with the nonlinear features of the systems is considered. Explicit relations have been obtained between nonlinear third-order susceptibilities and the spectral densities of the 2nd order over the external force. The general theory is applied to the investigation of electric fluctuations. Author

N74-27428*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
IMPROVED CURVE FITS FOR THE THERMODYNAMIC PROPERTIES OF EQUILIBRIUM AIR SUITABLE FOR NUMERICAL COMPUTATION USING TIME-DEPENDENT OR SHOCK-CAPTURING METHODS, PART 1 Final Report, 15 Nov. 1972 - 14 Nov. 1973
J. C. Tannehill and P. H. Mugge Feb. 1974 37 p refs
(Grant NGR-16-002-038; Proj. 930-S)
(NASA-CR-138654; ISU-ERI-AMES-74050-Pt-1) Avail: NTIS HC $5.00 CSCL 20M

Simplified curve fits for the thermodynamic properties of equilibrium air were devised for use in either the time-dependent or shock-capturing computational methods. The accuracies of these curve fits are substantially improved over the accuracies of previous curve fits. For the time-dependent method, curve fits were developed for p = p(e, rho), a = a(e, rho), and T = T(e, rho), while for the shock-capturing method, curve fits were developed for h = h(p, rho) and T = T(p, rho). The ranges of validity for these curve fits are for temperatures up to 25,000 K and densities from 10 to the -7th power to 1000 amagats. These approximate curve fits are particularly useful when employed on advanced computers such as the Burrough's ILLIAC 4 or the CDC STAR since they avoid the cumbersome table-lookup feature of the RGAS program. Author

N74-27429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMILARITY CONSTRAINTS IN TESTING OF COOLED ENGINE PARTS
Raymond S. Colladay and Francis S. Stepka Washington Jun. 1974 23 p refs
(NASA-TN-D-7707) Avail: NTIS HC $3.00 CSCL 21E

A study is made of the effect of testing cooled parts of current and advanced gas turbine engines at the reduced temperature and pressure conditions which maintain similarity with the engine environment. Some of the problems facing the experimentalist in evaluating heat transfer and aerodynamic performance when hardware is tested at conditions other than

the actual engine environment are considered. Low temperature and pressure test environments can simulate the performance of actual size prototype engine hardware within the tolerance of experimental accuracy if appropriate similarity conditions are satisfied. Failure to adhere to these similarity constraints because of test facility limitations or other reasons, can result in a number of serious errors in projecting the performance of test hardware to engine conditions. Author

N74-27430*# Advanced Technology Labs., Inc., Jericho, N.Y.
ANALYSIS OF SUPERSONIC COMBUSTION FLOW FIELDS WITH EMBEDDED SUBSONIC REGIONS
S. Dash and P. DelGuidice Nov. 1972 106 p refs
(Contract NAS1-10948)
(NASA-CR-112223; ATL-TR-169) Avail: NTIS HC $8.50 CSCL 21B

The viscous characteristic analysis for supersonic chemically reacting flows was extended to include provisions for analyzing embedded subsonic regions. The numerical method developed to analyze this mixed subsonic-supersonic flow fields is described. The boundary conditions are discussed related to the supersonic-subsonic and subsonic-supersonic transition, as well as a heuristic description of several other numerical schemes for analyzing this problem. An analysis of shock waves generated either by pressure mismatch between the injected fluid and surrounding flow or by chemical heat release is also described. Author

N74-27431# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
THERMOPHYSICAL AND THERMOCHEMICAL PROPERTIES
B. D. Faubion 1973 5 p ref Sponsored by AEC
(Contract DA-11-173-AMC-487(A))
(MHSMP-73-43-M) Avail: NTIS HC $3.00

The symmetry properties of the molecular vibrations of four possible configurations of HNAB were calculated. Author (NSA)

N74-27432# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANISM OF COMBUSTION PROPAGATION IN CERTAIN HETEROGENEOUS SYSTEMS AFTER A SHOCK WAVE
V. F. Komov and Ya. K. Troshin 11 Mar. 1974 6 p Transl. into ENGLISH from "Vsesoyuznaya Mezhvuzovskaya Konferentsiya po voprosam Ispareniya, Goreniya i Gazovoi Dinamiki Dispersnykh Sistem (5Th)" Tezisy dokladov, 1965 p 24-25
(AD-776889; FTD-HT-23-1102-74) Avail: NTIS CSCL 21/2

The rapid combustion of heterogeneous systems is studied, where a liquid or very viscous combustible (lubricating oil and materials, individual hydrocarbons, etc.) is applied as a thin layer 2-2000 micrometers on the surface of a duct inside which is oxygen gas. GRA

N74-27433# United Aircraft Corp., East Hartford, Conn.
DEVELOPMENT OF A COMBUSTOR FLOW ANALYSIS. PART 1: THEORETICAL STUDIES Final Report, 1 Jun. - 30 Sep. 1973
Robert F. Anasoulis, Henry Mcdonald, and Richard C. Buggeln 4 Apr. 1974 91 p refs
(Contract F33615-72-C-2042; AF Proj. 3066)
(AD-777137; AFAPL-TR-73-98-Pt-1) Avail: NTIS CSCL 21/2

A computational procedure for calculating the coupled flow and chemistry within both can-annular and annular gas turbine combustors is presented. The procedure solves the time-averaged Navier-Stokes equations with coupled chemistry including the effects of turbulence and droplet vaporization and burning, using a novel field relaxation method developed at the United Aircraft Research Laboratories. Although a relatively simple turbulence model is employed in the procedure, modification to this model is easily implemented within the framework of the computational method. Computations of the flow and chemistry within both can-annular and annular gas turbine combustors, conducted using the procedure, are presented and compared with experimental data. The results of the comparisons with data are obscured by three-dimensional effects present in real gas turbine combustors. However, the indications are that, for combustors where has considerable potential. Author (GRA)

N74-27434# Space Sciences, Inc., Monrovia, Calif.
THERMODYNAMIC PROPERTIES OF ROCKET COMBUSTION PRODUCTS AND NOZZLE MATERIALS Final Scientific Report, 15 Mar. 1969 - 31 Dec. 1973
Milton Faber 26 Feb. 1974 17 p refs
(Contract F44620-69-C-0071; AF Proj. 9750)
(AD-777180; AFOSR-74-0364TR) Avail: NTIS CSCL 07/4

Experimental thermodynamic data were obtained for 28 species and compounds relevant to rocket exhaust gases and refractory metals and their compounds. These experimental studies resulted in 15 publications in the international journals of chemical physics and physical chemistry. Abstracts of these papers are presented. Reported for the first time were thermal data for a number of mixed halides, chlorine and fluorine, of aluminum, boron and beryllium formed as exhaust species in liquid, solid and hybrid propellant systems. These published results have been employed for preparation of new JANAF Thermochemical Tables for previously unreported propulsion species and refractory compounds. New data were obtained for the gaseous oxides of vanadium as well as for the gaseous nitrides of vanadium and chromium. Heats of sublimation, vaporization and fusion for elemental vanadium and nickel were also determined. (Modified author abstract) GRA

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-27435* National Aeronautics and Space Administration, Washington, D.C.
NASA-MARKS 5TH ANNIVERSARY OF FIRST LUNAR LANDING
13 Jun. 1974 84 p
(NASA-News-Release-74-175) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 05D

The accomplishments of the Apollo 11 Flight are presented as a tribute to the fifth anniversary of the first landing on the moon. The document contains: (1) a general description of the Apollo 11 Flight, (2) Presidential statements, (3) Apollo historical summary, (4) Apollo mission facts, (5) information on astronauts who are no longer in the program, and (6) transcripts of the landing sequence and first extravehicular activities on the moon. Author

N74-27436# Civil Aeronautics Board, Washington, D.C.
LOCAL SERVICE AIR CARRIERS' UNIT COSTS. VOLUME 2: UNIT COSTS, COMPUTATIONS AND HISTORICAL DATA, YEAR ENDED 30 SEPTEMBER 1973
30 Sep. 1973 409 p refs
Avail: NTIS HC $23.50

The cost of local service air carriers is reported for various commercial transport aircraft. The subjects discussed are as follows: (1) aircraft performance and operating expenses for 15 types of commercial transport aircraft, (2) servicing expenses, (3) hourly depreciation rate and hourly rates for return on investment and tax allowance, and (4) the cost of aircraft and equipment purchased by certificated carriers and the percentage rate for return on investment and tax allowance. Author

N74-27437# Committee on Foreign Affairs (U. S. House).
SCIENCE, TECHNOLOGY, AND AMERICAN DIPLOMACY: THE POLITICAL LEGACY OF THE INTERNATIONAL GEOPHYSICAL YEAR
Harold Bullis Washington GPO Nov. 1973 69 p refs Presented to Subcomm. on Natl. Security Policy and Sci. Develop. of the Comm. on Foreign Affairs, 93d Congr., 1st Sess., Nov. 1973 Prepared by Library of Congr., Sci. Policy Res. Div.
(GPO-22-889) Avail: SOD HC $0.65

The accomplishments of the International Geophysical Year and their impact on the scientific communities of the participating nations are discussed. The subjects discussed during the

investigation are: (1) the background of the International Geophysical Year, (2) the scientific program, (3) the scientific results, and (4) the potential impacts. Tables of data are included to show the planning meetings conducted, the budgetary aspects, and the scientific areas represented during the IGY. Author

N74-27438# Committee on Public Works (U. S. Senate).
NONDEGRADATION POLICY OF THE CLEAR AIR ACT
Washington GPO 1973 421 p refs Hearing before Comm. on Public Works, 93d Congr., 1st Sess., 24 Jul. 1973
(GPO-20-928) Avail: Subcomm. on Air and Water Pollution

A Congressional hearing was conducted to discuss the possible effects of proposed legislation to relax the standards imposed by the clean air act. The provisions of various items of legislation to maintain prescribed cleanliness of water and air are analyzed. Statements from specific witnesses concerning their reaction to proposed changes in the legislation constitute the principal parts of the report. Statements are included concerning energy conversion techniques, effects of fuel consumption, and industrial pollution problems. Author

N74-27439# Joint Committee on Defense Production (U. S. Congress).
TWENTY-THIRD ANNUAL REPORT OF THE ACTIVITIES OF THE JOINT COMMITTEE ON DEFENSE PRODUCTION, CONGRESS OF THE UNITED STATES, WITH MATERIAL ON MOBILIZATION FROM DEPARTMENTS AND AGENCIES, PART 1
John Sparkman Washington GPO 1974 599 p refs Presented to the 93d Congr., 2d Sess., 5 Feb. 1974
(S-Rept-93-683-Pt-1) avail: US Capitol, Senate Document Room

The progress achieved in the execution and administration of the programs authorized under the Defense Production Act are reviewed. The joint Committee report includes information on energy contained in stockpile of materials, energy resources, U.S. dependence on foreign sources for metals and materials, reduction of stockpile objectives and proposed sale of materials, total Government inventories, future cash requirements, and upgrading of strategic and critical materials. Mobilization activities reports by the Office of Emergency Preparedness and 35 Federal departments and agencies are also presented. A.A.D.

N74-27440# Joint Committee on Defense Production (U. S. Congress).
TWENTY-THIRD ANNUAL REPORT OF THE ACTIVITIES OF THE JOINT COMMITTEE ON DEFENSE PRODUCTION, CONGRESS OF THE UNITED STATES, WITH MATERIAL ON MOBILIZATION FROM DEPARTMENTS AND AGENCIES, PART 2
John Sparkman Washington GPO 1974 630 p refs Presented to the 93d Congr., 2d Sess., 5 Feb. 1974
(S-93-683-Pt-2) Avail: US Capitol, Senate Document Room
For abstract, see N74-27439.

N74-27441# Committee on Appropriations (U. S. House).
DEPARTMENT OF DEFENSE APPROPRIATIONS FOR 1974. PART 5: OPERATION AND MAINTENANCE (EXCEPT RESERVE FORCES AND DEFENSE AGENCIES)
Washington GPO 1973 1825 p refs Hearings before Comm. on Appropriations, 93d Congr., 1st Sess., Jul. - Aug. 1973
(GPO-22-550) Avail: Subcomm. on Dept. of Defense

A Congressional hearing was held to present testimony on an increased FY 1974 budget request for DOD operations and maintenance activities. Major overall program increases are reported and key statistics for the following general areas are presented: (1) activity indicators; (2) financial obligations and outlays; (3) civilian personnel; (4) travel expenses; (5) Headquarters operation and administration; (6) aircraft inventories and utilization; (7) aircraft overhaul; (8) real property management; (9) telecommunication; and (10) dependents overseas education. Additional specific programs and requirements are presented for the Air Force, Army, Marine Corps, and Navy concerning such operations as logistic support, automatic data processing, medical programs, all-volunteer considerations, base operations, etc. Revolving and management funds are also discussed. A.A.D.

N74-27442# Committee on Government Operations (U. S. House).
ENERGY REORGANIZATION ACT OF 1973
Washington GPO 1973 427 p Hearings on H.R. 11510 before Comm. on Govt. Operations, 93d Congr., 1st Sess., 27-29 Nov. 1973
(GPO-25-108) Avail: Subcomm. on Legislation and Military Operations

Congressional hearings were conducted to reorganize and consolidate certain functions of the Federal Government in a new energy research and development administration and in a nuclear energy commission in order to promote more efficient management of such functions. The organization and functions of the organization are explained. Testimony is provided by selected witnesses to show the current level of effort in energy management and the expected benefits to be derived from the new organization. Author

N74-27443# Committee on Government Operations (U. S. House).
FEDERAL ENERGY ADMINISTRATION
Washington GPO 1973 307 p Hearings on H.R. 11793 before Comm. on Govt. Operations, 93d Congr., 1st Sess., 10-11 Dec. 1973
(GPO-26-725) Avail: Subcomm. on Legislation and Military Operations

Congressional legislation to reorganize and consolidate certain functions of the Federal Government in a new Federal Energy Administration is proposed. The organization and functions of the various offices are explained. Testimony from recognized experts in the energy field is reported to show the extent of the problem and their reactions to the government proposal. Author

N74-27444# Committee on Interstate and Foreign Commerce (U. S. House).
ENERGY EMERGENCY ACT
Washington GPO 1973 541 p Hearings on H.R. 11031, H.R. 11450, H.R. 11202, H.R. 11505, and H.R. 11509 before Comm. on Interstate and Foreign Com., 93d Congr., 1st Sess., 14, 15, 27, and 28 Nov. 1973
(GPO-26-038) Avail: Comm. on Interstate and Foreign Com.

Congressional hearings on an emergency energy act to give the President extraordinary powers to cope with the energy crisis are presented. The bill provides the President and State and local governments the power to develop contingency plans for reducing petroleum consumption, and assuring the continuation of vital public services in the event of emergency fuel shortages or severe dislocations in the nation's fuel distribution system, and for other purposes. Mandatory Federal actions to be taken to alleviate fuel shortages are described. Testimony of selected witnesses is reported to show the expected advantages of such action. Author

N74-27445# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1975 An Act to Authorize Appropriations to NASA for Research and Development, Construction of Facilities, and Research and Program Management, and for other Purposes
Frank E. Moss Washington NASA 1974 137 p refs Rept. to accompany H. R. 13998 presented by the Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 6 May 1974
(S-Rept-93-818; GPO-29-156) Avail: US Capitol, Senate Document Room

Congressional action on the fiscal year 1975 budget request for NASA is presented. The major portions of the request are for research and development, construction of facilities, and research and program management. The specific projects are identified and the funding for each project is established. Space and aeronautics programs of various departments and agencies of the government which coordinate with NASA are examined. The hearings consisted of testimony from witnesses within and without the government. Author

N74-27446# RAND Corp., Santa Monica, Calif.
THE PRICE ELASTICITY OF RESIDENTIAL ENERGY USE
Kent P. Anderson Feb. 1974 21 p refs

(P-5180) Avail: NTIS HC $4.25

The long-run price elasticity estimates obtained in several recent studies of residential gas and electricity demands are discussed. The nature of responses to price and, in particular, to the role of inter-fuel substitution compared with the role of alterations in usage rates or the size, efficiency, and features of new and renovated equipment are examined. The own- and cross-price elasticities obtained in these studies imply that large equal percentage increases in the prices of all types of energy sources would eventually lead either to marked increases in energy conservation or to a shift from utility gas and electricity to other sources of energy. Latter interpretation is intuitively implausible for price increases that would apply to all types of energy. But the alternative interpretation -- that there is a quantitatively significant link between energy price and the degree of energy conservation -- is not well supported by casual observation.

Author

N74-27447# RAND Corp., Santa Monica, Calif.

ENERGY ALTERNATIVES FOR CALIFORNIA: THE CURRENT CRISIS. 4: REGULATORY ASPECTS OF ENERGY POLICY

William R. Harris Jan. 1974 19 p refs

(P-5158) Avail: NTIS HC $4.00

A study on energy alternatives for the State of California was conducted. The study contains the following considerations: (1) sources and uses of energy for California, (2) conservation of energy, (3) planning for fuel shortages and other energy emergencies, and (4) Federal-State interactions on energy policy. Emphasis is placed on short range solutions to immediate problems resulting from Arab oil export policies and the resultant impact on the availability of required sources of power in California.

Author

N74-27448# Committee on Interior and Insular Affairs (U. S. Senate).

NUCLEAR STIMULATION OF NATURAL GAS

Washington GPO 1973 894 p refs Hearing before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 11 May 1973

(GPO-96-678) Avail: Subcomm. on Public Lands

A Congressional hearing was conducted on Project Rio Blanco, Colorado, to determine the uses versus the hazards of stimulating the production of natural gas from tight-rock formations by the use of nuclear devices. Fission product activity whereby the detonation of a 30-kiloton nuclear bomb triggers the transformation of chimney gas deposits into usable energy is explained. The effects to the environment of the resulting radioactivity is discussed along with the following matters: (1) the purposes of the test; (2) the costs of the test, both economic and environmental; (3) reasonable alternatives to nuclear stimulation; (4) whether Project Rio Blanco should proceed; (5) consumer acceptance; and (6) the future of the technology. A.A.D.

N74-27449# Committee on Interior and Insular Affairs (U. S. Senate).

NATIONAL MATERIALS POLICY

Washington GPO 1973 518 p refs Hearings before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 30-31 Oct. and 1 Nov. 1973

(GPO-24-903) Avail: Subcomm. on Minerals, Mater., and Fuels

A Congressional national hearing was conducted to hear testimony concerning national requirements for raw materials and their supply, use, recovery, and disposal. Demand and supply trends and potentials of raw materials, including nonferrous metals, crushed stone, and wood are discussed with emphasis on their conservation and recycling. Environmental and economic impacts of future production levels are considered along with the effects of international trade in mineral resources. Conclusions and recommendations for the formulation of a national materials policy which takes into account both the environment and the economy are presented. A.A.D.

N74-27450# Committee on Interior and Insular Affairs (U. S. Senate).

COAL POLICY ISSUES. PART 2: APPENDIX 3: ADDITIONAL STATEMENTS RECEIVED FOR THE RECORD

Washington GPO 1973 569 p refs Hearings before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1973

(GPO-20-768) Avail: Comm. on Interior and Insular Affairs

The reliability and adequacy of bulk power supplies in the U.S. was discussed in a Congressional hearing to determine present and future energy needs towards the formulation of a national energy policy. The coal industry is discussed in terms of: (1) extraction, including mine safety; (2) transportation, including reestablishment and reequipping of the railroads; (3) combustion, including new technologies and reequipping of the railroads; (3) combustion, including new technologies for the more efficient use of coal; (4) conversion of coal to low-sulphur gases, liquids, or solids; and (5) ecological considerations, including mine drainage and refuse treatment, power plant particulate emission from coal combustion, and strip mine reclamation. Present coal-fired generating capacity is reported according to figures presented by utility companies from different sections of the country, and general trends in energy consumption and coal utilization are observed for nine regions of the National Electric Reliability Council. A.A.D.

N74-27451# Joint Publications Research Service, Arlington, Va.

GENERAL MEETING OF USSR ACADEMY OF SCIENCES

5 Jun. 1974 12 p Transl. into ENGLISH from Sots. Industriya (Moscow), 6 Mar. 1974

(JPRS-62172) Avail: NTIS HC $4.00

The report contains speeches by the President of the U.S.S.R. Academy of Sciences, M. V. Keldysh and the Acting Scientific Secretary of the Presidium of the U.S.S.R. Academy of Sciences G. K. Skryabin to the annual meeting of the academy. Past accomplishments of the organization are discussed and future plans for scientific research are examined. Author

N74-27452# Joint Publications Research Service, Arlington, Va.

REGIONAL PROBLEMS OF SCIENTIFIC, TECHNICAL PROGRESS

N. N. Nekrasov and V. I. Duzhenkov 3 Jun. 1974 19 p refs Transl. into ENGLISH from Priroda (Moscow), no. 2, 1974 p 2-9

(JPRS-62140) Avail: NTIS HC $4.00

The report contains an examination of the rational distribution of the country's scientific potential according to economic regions. The charateristics of the regions of the U.S.S.R. which determine the type of scientific activity to be conducted are analyzed. It is concluded that proper distribution of the country's scientific potential according to economic regions will make it possible to solve the most important scientific problems connected with natural wealth and for raising the standard of living in the U.S.S.R. Author

N74-27453*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN EVALUATION OF CONTRACTOR PROJECTED AND ACTUAL COSTS

Kent A. Kwiatkowski and Charles Buffalano Washington Jun. 1974 16 p ref

(NASA-TN-D-7644; D-7644; G-7407) Avail: NTIS HC $3.00 CSCL 05C

GSFC contractors with cost-plus contracts provide cost estimates for each of the next four quarters on a quarterly basis. Actual expenditures over a two-year period were compared to the estimates, and the data were sorted in different ways to answer several questions and give quantification to observations, such as how much does the accuracy of estimates degrade as they are made further into the future? Are estimates made for small dollar amounts more accurate than for large dollar estimates? Other government agencies and private companies with cost-plus contracts may be interested in this analysis as potential methods of contract management for their organizations. It provides them with the different methods one organization is beginning to use to control costs. Author

N74-27454# Committee on Government Operations (U. S. House).

DRAFT OF PROPOSED LEGISLATION TO PROMOTE MORE EFFECTIVE MANAGEMENT OF CERTAIN RELATED

FUNCTIONS OF THE EXECUTIVE BRANCH Communication from the President of the United States
Washington GPO 1973 83 p refs Presented to Comm. on Govt. Operations, 93d Congr., 1st Sess., 29 Jun. 1973
(H-Doc-93-119; GPO-83-011) Avail: US Capitol, House Document Room

Congressional action to draft a proposed legislation to promote more effective management of certain related functions of the Executive Branch was conducted. The proposal involves reorganizing and consolidating those functions in a new department of energy and natural resources. Also considered in a new energy research and development administration. The interrelated operations of the energy administration with other governmental functions are examined. Author

N74-27455# Committee on Public Works (U. S. House).
ENERGY EMERGENCY ACT From Committee of Conference
Harley O. Staggers Washington GPO 7 Feb. 1974 103 p refs Report to accompany S. 2589 presented by Comm. on Public Works at the 93d Congr., 2d Sess., 7 Feb. 1974
(H-Rept-93-793) Avail: US Capitol, House Document Room

Congressional action with respect to an Energy Emergency Act is presented. The establishment and functions of the Federal Energy Emergency Administration are defined. Energy conservation plans which can be implemented in a short time are proposed. Some of the provisions of the bill include the following: (1) coal conversion and allocation, (2) Federal actions to increase available domestic petroleum supplies, (3) prohibition on inequitable prices, (4) protection of franchised dealers, (5) antitrust procedures, and (6) administrative procedure and judicial review. Author

N74-27456*# Stanford Research Inst., Huntsville, Ala.
DEVELOPMENT OF METHODOLOGIES AND PROCEDURES FOR IDENTIFYING STS USERS AND USES Final Report
J. L. Archer, N. A. Beauchamp, and D. C. MacMichael 20 Jun. 1974 178 p refs
(Contract NAS8-30533)
(NASA-CR-120258; SRI-H-4-165) Avail: NTIS HC $12.00 CSCL 05B

A study was conducted to identify new uses and users of the new Space Transporation System (STS) within the domestic government sector. The study develops a series of analytical techniques and well-defined functions structured as an integrated planning process to assure efficient and meaningful use of the STS. The purpose of the study is to provide NASA with the following functions: (1) to realize efficient and economic use of the STS and other NASA capabilities, (2) to identify new users and uses of the STS, (3) to contribute to organized planning activities for both current and future programs, and (4) to air in analyzing uses of NASA's overall capabilities. Author

N74-27457# Advisory Group for Aerospace Research and Development, Paris (France).
HOW TO OBTAIN INFORMATION IN DIFFERENT FIELDS OF SCIENCE AND TECHNOLOGY: A USER'S GUIDE
May 1974 120 p refs
(AGARD-LS-69) Avail: NTIS HC $9.00

The principles of information systems are outlined that provide storage, retrieval, and dissemination of technical information to scientists. For individual titles, see N74-27458 through N74-27464.

N74-27458 Pittsburgh Univ., Pa.
PRESENT KNOWLEDGE DOMAIN OF SCIENTISTS AND TECHNOLOGISTS
A. Debons *In* AGARD How to Obtain Inform. in Different Fields of Sci. and Technol. May 1974 7 p refs (For availability see N74-27457 16-34)

Available data resources in several scientific and technological areas are promoted. Effective use of such data resources depends on some understanding of how information is generated, used and given to others. Influences of organismic variables on our ability to acquire and process data and the direct use of the resulting information in decision making and problem solving are considered. The way certain variables involved in these functions relate to the use of data bases is emphasized. Author

N74-27459 Pittsburgh Univ., Pa.
GENERATION, USE, AND TRANSFER OF INFORMATION
Allen Kent *In* AGARD How to Obtain Inform. in Different Fields of Sci. and Technol. May 1974 7 p refs (For availability see N74-27457 16-34)

The information explosion has produced an effect that has not been widely recognized. The inability of individuals to read all potentially relevant material has changed the nature of questions asked. Now, questions are asked more frequently that relate to a problem, with the aspects of the question derived from the problem at hand rather than recalled from previous contact with specific items of the literature. Information systems have attempted to respond to this change through deeper analysis of materials, and coordination of desired aspects of subject matter using computers. The need for connection between the terminology of questions posed and the available analytics has become more critical. More precise control of vocabulary is needed, leading to the construction of mechanisms such as thesauri. Author

N74-27460 Farbwerke Hoechst A.G., Frankfurt (West Germany).
INTERNATIONAL MEDICAL INFORMATION SYSTEMS
Georg E. Unger *In* AGARD How to Obtain Inform. in Different Fields of Sci. and Technol. May 1974 7 p (For availability see N74-27457 16-34)

The flood of information especially in medical sciences can with no means, and especially not with the well known conventional means, be accomplished today. Even the creation of localized medical information systems can not cover the demands the medical profession is bringing forward. With the use of computers new ways are opened. Various methods have been developed in order to analyze, organize and evaluate the present voluminous flood of information. Communication between existing printed information and the medical profession in all fields of this science is considered. A new automated on-line terminal oriented storage and information retrieval system is discussed on a worldwide international basis. Author

N74-27461 Rome Air Development Center, Griffiss AFB, N.Y.
FEDERAL INFORMATION SYSTEMS
Fred S. Dyer *In* AGARD How to Obtain Inform. in Different Fields of Sci. and Technol. May 1974 10 p refs (For availability see N74-27457 16-34)

The Federal Technical Information System is the Federal coordinator and distributor of U.S. Government sponsored research and analytical reports to the general public. Inputting or participating with this repository are a number of other Government repositories that are responsible for performing functions parallel to NTIS for the communities they serve and in some cases they also manage the classified/limited portions of their respective collections. Author

N74-27462 Pittsburgh Univ., Pa. Knowledge Availability Systems Center.
THE NASA REGIONAL DISSEMINATION CENTER
Edmond Howie *In* AGARD How to Obtain Inform. in Different Fields of Sci. and Technol. May 1974 7 p (For availability see N74-27457 16-34)

An overview is presented of the Knowledge Availability Systems Center and its role as a National Aeronautics and Space Administration Regional Dissemination Center. Particular emphasis is placed on the marketing, technical analysis, technical operations and engineering consultation functions of the center as they relate to user exploitation of its mechanized information resources. Author

N74-27463 Lockheed-Georgia Co., Marietta. Technical Information Dept.
INTERNATIONAL INFORMATION SYSTEMS FOR PHYSICAL SCIENTISTS
Charles K. Bauer *In* AGARD How to Obtain Inform. in Different Fields of Sci. and Technol. May 1974 60 p refs (For availability see N74-27457 16-34)

The numerous sci-tech information sources are discussed which provide retrieval service to outside users. Description of these sources was made by means of a questionnaire sent to centers throughout the world. Based on the response, information about these sources includes their name and address, subject fields and kind of collection maintained, retrieval systems

employed, publications issued, and services supplied. In assessing international information retrieval and transfer, problems of the information seeker, industrial and technological conditions among nations, source selection, accessibility, duplication, standardization, and language barriers as influences upon information receipt and utilization are discussed. A review is given also of cooperative efforts made by government sponsored world organizations and international professional bodies to ameliorate prevailing conditions. Author

N74-27464 Syracuse Univ., N.Y.
ENVIRONMENTAL INFORMATION SYSTEMS
Marta L. Dosa *In* AGARD How to Obtain Inform. in Different Fields of Sci. and Technol. May 1974 18 p refs (For availability see N74-27457 16-34)

Research, academic and popular trends in the environmental fields and characteristics of information users, resources and systems, are explored. The multidisciplinary nature of environmental information is analyzed. The following operational definition is used: Ecology provides an inclusive and consistent structure for perceiving the world and accounts for the behavior of man within the world structure. Systems yielding environmental information are categorized as problem centered or discipline oriented. Author

N74-27465# Select Committee on Small Business (U. S. House).
PHASE 4OIL REGULATIONS AND PETROLEUM MARKETING PROBLEMS
Washington GPO 1973 584 p refs Hearings before Select Comm. on Small Business, 93d Congr., 1st Sess., 18 Sep. and 23-24 Oct. 1973
(GPO-24-574) Avail: Subcomm. on Activities of Regulatory Agencies

A Congressional hearing was conducted to examine the petroleum products marketing problems of small businesses. The government regulations and procedures for controlling petroleum supplies are examined. The cost control actions are analyzed to determine their impact on the petroleum distributors. Statistical analyses of the petroleum industry are included in the form of tables and graphs to show the supply and demand aspects of the problem. Author

N74-27466# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REPORT ON THE PRODUCTION PROGRAM OF THE AEROSPACE INDUSTRY IN 1972-1976
20 Feb. 1974 60 p Transl. into ENGLISH from Japan Aviation Ind. Assoc. Rept. (Japan), 31 Mar. 1973 p 1-51
(AD-776112; FTD-HC-23-810-74) Avail: NTIS CSCL 05/3

The aviation industry of Japan was re-established in 1952, and the industry is being developed slowly but steadily in both qualitative and quantitative aspects. The object of this study is to estimate and analyze the production scale and items required to deal with in the next five years, as references for industrial management and national policy implementation. GRA

N74-27467# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS REPORT, AUGUST 1973
Aug. 1973 71 p refs
(PB-227353/0) Avail: NTIS HC $3.75 CSCL 05B

Contents: The underwater sound reference division and 32 years of sonar calibration and standards, reference hydrophones-yesterday and today, progress notes in acoustics, atmospheric physics, communications sciences, electronics, metallurgy, nuclear and atomic physics, ocean sciences, ocean technology, plasma physics, radar, space science, papers by NRL staff members. GRA

N74-27468# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 28, NUMBER 1
B. J. McDonald and Victoria Hewitson 31 Jan. 1974 43 p
(AD-777709; ESN-28-1) Avail: NTIS CSCL 05/2

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. Author (GRA)

N74-26817* Naval Fleet Missile Systems, Corona, Calif. Analysis and Evaluation Group.
GOVERNMENT-INDUSTRY DATA EXCHANGE PROGRAM (GIDEP)
Edwin T. Richards *In* NBS The Role of Cavitation in Mech. Failures Apr. 1974 p 166-170 (For availability see N74-26800 16-12)
CSCL 05B

ON-GOING RESEARCH PROJECTS

1. AERODYNAMICS

Includes Aerodynamics of Bodies, Combinations, Internal Flow in Ducts and Turbomachinery; Wings, Rotors, and Control Surfaces. For Applications See: 02 Aircraft and 31 Space Vehicles. For Related Information See Also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

1.0001, STUDY OF VISCOUS FLOW ABOUT AIRFOILS BY THE INTEGRO-DIFFERENTIAL METHOD
J.C. WU, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (501-06-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3. AUXILIARY SYSTEMS

Includes Fuel Cells, Energy Conversion Cells, and Solar Cells; Auxiliary Gas Turbines; Hydraulic, Pneumatic and Electrical Systems; Actuators; and Inverters. For Related Information See Also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

3.0001, DEVELOPMENT OF IMPROVED CATHODE SYSTEMS FOR HIGH ENERGY PRIMARY BATTERIES
M.M. NICHOLSON, Rockwell International Corp., *Canoga Park, California* 91304 (F19628-74-C-0068)

AF function - advanced missile applications. Deficiency - excessive weight and volume of existing battery power sources. Research - into alternative electrochemical power sources. How research contributes - assists in development of new battery types with improved energy density and reliability. Methods of preparing and evaluating practical semiconductor fluoride cathodes for high energy battery applications will be investigated. The emphasis will be placed on studies of the mechanism of the cathodic passivation process previously observed for these materials in nonaqueous electrolyte solutions. Fabrication and electrochemical evaluation methods will be investigated for porous cathode structures using n-type cadmium fluoride, zinc fluoride and related materials developed in the program.

Supporting agency address information: AF Cambridge Research Laboratories, L.G. Hanscom Field, Bedford, Mass. 01730.

SUPPORTED BY U.S. Dept. of Defense - Air Force

4. BIOSCIENCES

Includes Aerospace Medicine, Exobiology, Radiation Effects on Biological Systems; Physiological and Psychological Factors. For Related Information See Also: 05 Biotechnology.

4.0001, UTRICULAR INFLUENCES ON VISUAL MOTOR CONTROL RESEARCH
C.H. MARKHAM, Univ. of California, Graduate School, *Los Angeles, California* 90024 (970-21-11)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0002, EFFECT OF BEDREST ON INSULIN RESISTANCE
G.M. REAVEN, Stanford University, School of Medicine, *Palo Alto, California* 94305 (970-21-14)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0003, MECHANISMS OF INNATE AND ENTRAINED PATTERNS IN NEURONS
F. STRUMWASSER, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109

The research objectives are concerned with a continuing search for principles operating in the nervous system that organize the non- reflexive behaviors, particularly those that are periodic. All of the research will be performed on the sea hare, Aplysia californica (Mollusca: Opisthobranchia) and other belated mollusks. The methods of research will be very broad-based. They will include quantitative behavioral measurements, multiunit and single neuron recordings in intact subjects and dissected (in-vitro) preparations, electron microscopy of nervous tissue, the use of organ-cultured ganglia and biochemical measurements on whole ganglia and on single neurons. The titles of the six major projects are as follows: I. The nature and mechanism of action of the egg-laying hormone on behavior. II. Morphological, electrophysiological and biochemical studies of the circadian rhythm in the eye. III. CNS organization leading to the circadian locomotor rhythm. IV. Synaptic organization of a neuron with a circadian rhythm and its relevance for entrainment by photoperiod. V. The synthesis and turnover of proteins in single neurons in relationship to their activity and circadian rhythm. VI. Dynamic aspects of long- term neuronal interactions studied under organ-culture conditions.

SUPPORTED BY U.S. Dept. of Hlth. Ed. & Wel. - N.I.H.

4.0004, MICROANALYSIS OF BLOOD PLASMA
O. LOWRY, Washington University, Graduate School, *St. Louis, Missouri* 63130 (948-60-90)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0005, ANALYSIS OF BODY CALCIUM
P.C. JOHNSON, Baylor University, School of Medicine, *Houston, Texas* 77025 (970-51-14)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0006, PROCESSING ELECTROPHYSIOLOGICAL SIGNALS
D.C. LAI, Univ. of Vermont, School of Technology, *Burlington, Vermont* 05401 (970-21-11)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0007, CIRCADIAN PATTERNS OF NORMAL & PATHOLOGICAL FUNCTIONS
F.W. FINGER, Univ. of Virginia, School of Arts, *Charlottesville, Virginia* 22903

We hope to account for the previously-demonstrated individual differences in rat general activity under conditions of

high ambient temperature by relating them to the circadian variation of core temperature. Further, we will examine the dissociation of the temperature rhythms of activity, eating, and drinking, under conditions of light:dark reversal.

We will extend our previous comparison of period of running cycle under conditions of continuous illumination and of reversal of light:dark, by working from a base of LD 14:10 instead of LD12:12. This should yield a more dependable picture of the resetting process that presumably underlies period length in both situations.

We hope also to continue our studies of ulceration caused by inescapable electric shock, examined under free-running (e.g., continuous darkness) conditions as well as LD12:12.

SUPPORTED BY U.S. Dept. of Hlth. Ed. & Wel. - A.D.M.A.

4.0008, SPACE NUCLEAR SYSTEMS STUDIES
J.F. PARK, Battelle Memorial Institute, *Richland*, *Washington* 99352

Description: Space vehicles containing nuclear reactors or radionuclide power sources present special hazards in case of early abort or upon return from orbit. These problems are principally concerned with the biological effects of intensely radioactive, small insoluble particles. Our concern is with certain specific aspects of this problem, and, in cooperation with other groups, to assist in overall evaluations required for pursuance of Space Nuclear systems (SNS) programs.

SUPPORTED BY U.S. Atomic Energy Commission

5. BIOTECHNOLOGY

Includes Life Support Systems, Human Engineering; Protective Clothing and Equipment; Crew Training and Evaluation, and Piloting. For Related Information See Also: 04 Biosciences.

5.0001, LIQUID PHASE CATALYTIC REFORMING OF ORGANIC SPACECRAFT WASTE
M. MODELL, Mass. Inst. of Technology, School of Engineering, *Cambridge*, *Massachusetts* 02139 (970-22-23)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0002, ANNOYANCE FACTORS IN AIRCRAFT SOUND
J.L. FLETCHER, Memphis State University. Graduate School, *Memphis*, *Tennessee* 38111 (501-09-02)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0003, UPDATE AND IMPROVEMENT OF INTERACTIVE MAN-COMPUTER SYSTEM
V.E. SUOMI, Univ. of Wisconsin, Inst. For Environmental Stud., *Madison*, *Wisconsin* 53706 (611-13-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6. CHEMISTRY

Includes Chemical Analysis and Identification (e.g., Spectroscopy). For Applications See: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

6.0001, ZERO SOLIDIFICATION OF NACL-LIF EUTECTIC -131 ENTITLED - SODIUM CHLORIDE-LITHIUM FLUORIDE EUTECTIC
A.S. YUE, Univ. of California, Graduate School, *Los Angeles*, *California* 90024 (966-30-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0002, REACTIONS OF OXY RADICALS WITH NO, NO2, SO2, AND CO
D.G. HENDRY, Stanford Research Institute, *Menlo Park*, *California* 94025 (72P16057)

Objective of proposed research is to study reactions of hydroperoxy, acylperoxy, alkylperoxy, and alkoxy radicals with NO, NO2, SO2, and CO and to evaluate rate constants in gas-phase for temperature range of 25-100C. General procedure will be to generate desired radical in reaction where radical can compete for NO, NO2, SO2 or CO along with major reactant where rate constant is known. In this way rate constant may be evaluated for reactions of interest. Reactions will be followed continuously by IR or UV. Both disappearance of reactants and formation of products will be followed.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

6.0003, AN INVESTIGATION OF GAS PHASE OZONOLYSIS RATES
D.G. WILLIAMSON, Calif. State Univ. & Colleges, School of Science, *San Luis Obispo*, *California* 93401 (72P00705)

Large discrepancies exist for second order rate constants for the reaction of ozone with internal olefins. Rate constants determined at reactant concentration of microatmospheres differ appreciably from those determined at milliatmospheres. It is proposed to resolve these discrepancies by measuring the second order rate constants from microatmosphere concentrations to milliatmosphere concentrations using the same experimental method. It is proposed, as well, to quantitatively measure the reactivity of aldehydes and ketones with ozone in the gas phase. Evidence for chain decomposition of ozone will be sought. The gas phase stopped flow apparatus will be constructed to perform the proposed research. Ozone concentrations will be measured by a multiple reflection light absorption apparatus. From the time decay curves of ozone concentration, second order rate constants can be calculated.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

6.0004, INVESTIGATION OF PHYSICAL STRUCTURE OF POROUS CATALYSTS AND ABSORBENTS
C. OPR, Georgia Inst. of Technology, School of Chemical Engineering, *Atlanta*, *Georgia* 30332 (970-22-21)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0005, OXIDATION MECHANISMS ON SUPPORTED CHROMIA CATALYSTS
R.G. SQUIRES, Purdue University, School of Chemical Engineering, *Lafayette*, *Indiana* 47907 (72P00064)

The long range objective of the project is to simultaneously apply spectroscopic, gravimetric and kinetic analysis to the heterogeneous catalytic reactions of carbon monoxide and oxides of nitrogen on supported chromia catalysts in order to gain a better understanding of the interactions between the reacting gases, catalyst and support during adsorption and catalysis. Our goals for the current year include, a) the construction of recirculating gradientless flow reactors; b) purchase and installation of the infrared spectrometer; and c) determination of the conditions and parameters influencing the kinetic studies of the catalytic reactions on chromia.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

6.0006, TRACE GAS MONITORING SYSTEM
J. WYNTJES, Block Engineering Incorporated, *Cambridge*, *Massachusetts* 02139 (72P20094)

The purpose of this contract is to obtain a mobile, trace gas monitoring system based on Fourier Transform Infrared Spectroscopy for use in field studies (California Aerosol Characterization Study - 1972; Regional Air Pollution Study, St. Louis - 1973 and 1974); in laboratory studies of infrared absorption and emission of aerosols; and monitoring the Branch's very large (30 ft long) smog chamber. The contractor will fabricate, demonstrate, and deliver a Fourier Transform Infrared Spectroscopic system

for analysis of trace gases, demonstrate system in a laboratory site in Los Angeles, and install the system in an Environmental Protection Agency mobile laboratory. System will consist of the following components: Interferometer, source and detectors, data system, long path cell, gas handling equipment. Specific and sensitive analytical methods exist for a number of the more common pollutants. However, there are a number of important pollutants for which sensitive, specific, and near real time measurement techniques have not previously been available. These include aerosol precursors, oxygenated organic compounds, and oxidants, e.g., NH3, HNO3, N2CO, HCOOH, RCHO, RCOOH, H2O2, PAN's, HNO2, and possibly other species. Recent advances in instrumentation have led to the development of Fourier Transform Spectroscopy. Work under laboratory conditions has shown that this technique can be used for analysis at ppb concentration levels of NH3, HNO3, H2CO, HCOOH, H2O2 in the presence of other air pollutants and water vapor. Pollutants such as CO, CH4, NO, NO2, SO2, and O3 can also be determined although other techniques are available for these. It is reasonable to suppose that other air pollutants can also be measured by this technique. This kind of system is needed as part of the Chemistry and Physics Branch mobile laboratory for field studies.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

6.0007, THE CONVERSION OF MODEL COAL LIQUIDS COMPOUNDS TO NAPHTHA SPECIES
H.W. HAYNES, Univ. of Mississippi, School of Engineering, *University*, *Mississippi* 38677

Grant GI-36597X issued January 1, 1973, is being continued. This program is an investigation of the mechanisms by which coal-derived liquids of high molecular weight may be converted to napthas over various catalyst types, seeking a path of minimum hydrogen consumption. The effort will emphasize screening of catalyst for converting model coal liquids to species boiling in the naptha range. The culmination of the research will be a test with a real coal liquid.

SUPPORTED BY U.S. Natl. Science Foundation

6.0008, ROLE OF H2O IN PHOTOCHEMICAL REACTIONS
J.J. BUFALINI, U.S. Environ. Protection Agcy., Natl. Environ. Research Center, *Durham*, *North Carolina* 27711 (72P18352)

Published data on the effect of water vapor on photooxidation reactions are often confusing and contradictory. Some preliminary work suggests that organic acids are produced when hydrocarbons are photooxidized in the presence of water vapor. The work proposed is to photooxidize hydrocarbons (olefins, paraffins, and aromatics) in the presence of oxides of nitrogen and varying amounts of water vapor. The rate of reactant disappearance will be noted as well as product formation. The new Fourier transform spectrometer coupled to a long-path irradiation cell will be employed in these studies. In other cases where a complete carbon and nitrogen balance are desired, chromatographic, chemiluminescent and wet chemical detectors will be employed with a large borosilicate flask serving as the reaction vessel. This work will begin in the second quarter of FY 1973.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

6.0009, PHOTOCHEMICAL OXIDATION OF AROMATIC HYDROCARBONS
R. KUNTZ, U.S. Environ. Protection Agcy., Natl. Environ. Research Center, *Durham*, *North Carolina* 27711 (72P18350)

The photooxidation of aromatic hydrocarbons is poorly understood. Although it is commonly accepted that atomic oxygen (resulting from NO2 photodissociation) will initiate the oxidation of aromatics, the actual mechanism is not well understood. The products resulting from the carbon fragments have not been adequately identified since the carbon balance in these systems is usually poor. This study will make use of all of the conventional methods as well as the new Fourier Transform Spectroscopy system. This project will begin in January, 1973 and will end in June, 1973.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

6.0010, REACTIONS OF ELECTRONICALLY EXCITED SO2
J.P. HEICKLEN, Penn. State University, School of Science, *University Park*, *Pennsylvania* 16802 (72P18483)

Our previous work on the studies of the photochemistry of SO2 in the presence of CO, C2F4, or thiophene have indicated that the chemically important electronically excited states are not the luminescent states. Two new non-emitting states, a singlet and a triplet, were indicated. The existence of the triplet has now been confirmed by observations on the SO2-sensitized biacetyl emission. It is proposed to extend the studies of the photochemistry of SO2 by (1) Performing SO2-sensitized biacetyl emission studies in the presence of other gases such as CO2, CO, O2, NH3, H2S, OCS, N2O, H2O, pyridine, pyrrole, thiophene, and hydrocarbons, (2) Performing photochemical studies on systems with NH3, H2S, N2O, pyridine, and pyrrole, and (3) Performing photochemical studies with hydrocarbons where aerosols are produced, in order to study aerosol formation and growth. In the photochemical studies, experiments will be done in the absence and presence of N2, NO, and O2. Products of the reactions, as well as quantum yields, will be determined as a function of pressure of reactants, intensity of the absorbed radiation, temperature, and incident wavelength. Analysis will be primarily by emission spectroscopy, gas chromatography, and infrared spectroscopy, though mass spectroscopy will be used when appropriate. For those reactions in which aerosols are produced, their particle size distribution as a function of irradiation time will be determined directly in a thermal diffusion chamber, as well as indirectly by pressure drop and light scattering measurements.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

6.0011, STUDY TO DETERMINE PYROLYSIS & COMBUSTION PRODUCTS OF POLYMERS
I.N. EINHORN, Univ. of Utah, Graduate School, *Salt Lake City*, *Utah* 84112 (501-21-22)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

9. ELECTRONIC EQUIPMENT

Includes Electronic Test Equipment and Maintainability; Component Parts, E.G., Electron Tubes, Tunnel Diodes, Transistors, Integrated Circuitry; Microminiaturization. For Basic Research See: 10 Electronics. For Related Information See Also: 07 Communications and 21 Navigation.

9.0001, HEAT TRANSFER SYSTEMS WITH THERMAL CAPACITORS
H.A. WALLS, Univ. of Texas, School of Engineering, *Austin*, *Texas* 78712

Description: The National Aeronautics and Space Administration is currently orbiting manned space stations about the earth. Both active and passive devices are used to control the onboard heat transfer systems. One of the passive thermal controls involves the use of thermal capacitors in the heat transfer loops.

An experimental investigation has been carried out by Mr. Humphries at the Marshall Space Flight Center on thermal capacitors which employ the latent heat effect at the solid-liquid transition. Results from the analysis of this work have provided improved design criteria and estimates of performance for such thermal capacitors. Technical effort on this project is now completed, and results are available in a dissertation by W. R. Humphries.

SUPPORTED BY University of Texas

10. ELECTRONICS

Includes Circuit Theory; and Feedback and Control Theory. For Applications See: 09 Electronic Equipment. For Related Information See Specific Physics Categories.

10.0001, QUANTITATIVE DETERMINATION OF ZERO-EFFECTS ON ELECTRONIC MATERIALS PROCESSING ENTITLED INTERFACE MARKING IN CRYSTALS
H.C. GATOS, Mass. Inst. of Technology, School of Engineering, *Cambridge*, *Massachusetts* 02139 (966-30-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

11. FACILITIES, RESEARCH AND SUPPORT

Includes Airports; Lunar and Planetary Bases Including Associated Vehicles; Ground Support Systems; Related Logistics; Simulators; Test Facilities (e.g., Rocket Engine Test Stands, Shock Tubes, and Wind Tunnels); Test Ranges; and Tracking Stations.

11.0001, DETAILED DESIGN AND CONSTRUCTION OF PARTICULATE AERODYNAMIC TEST FACILITY
A. ANDERSON, Acurex Corporation, *Mountain View, California* 94040 (72P20140)

This effort will design and construct a particulate aerodynamic test facility for use by RLB-CSD to study basic particle flow and particulate collection mechanisms, develop and calibrate gas flow equipment and evaluate particle measuring techniques. The unit will be capable of simulating flue gas composition, flow regimes and temperatures as found in and around stationary source control equipment. A two-foot diameter test section, 40 feet long, with flow velocities up to 90 fps will be available. The unit employs flue gas recirculation with once through particulate flow. Temperature control is 70-500 degrees F, humidity 5-95%, velocity 5 to 90 feet/second and solids loading from 0-5 grains per cubic foot.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

11.0002, NEGATIVE PRESSURE CHAMBER
J. KLINE, Univ. of Miami, School of Engineering, *Miami, Florida* 33124 (141-93-02)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

12. FLUID MECHANICS

Includes Boundary-layer Flow; Compressible Flow; Gas Dynamics; Hydrodynamics; and Turbulence. For Related Information See Also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

12.0001, THE DYNAMICS OF CONCENTRATED VORTICES
T. MAXWORTHY, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007

This research project details the experimental investigation of concentrated vortices. The three main areas of study are: 1) Laboratory studies of buoyant vortex bubbles and thermals in unstratified, stratified and turbulent atmospheres; 2) The dynamics of large concentrated vortices - simulation and scaling laws; 3) Dust devil dynamics - large scale experiments and possible field tests.

SUPPORTED BY U.S. Natl. Science Foundation

12.0002, DYNAMIC EFFECTS OF SURFACTANTS ON INTERFACIAL FLUID PROPERTIES
D.T. WASAN, Illinois Inst. of Technology, School of Engineering, *Chicago, Illinois* 60616

The objective of this research is to conduct a systematic experimental study of the dynamic effects of surface active agents on interfacial hydrodynamic properties. The experimental work will emphasize physiochemical aspects which may result in significant interfacial shear and dilatationai viscosities or interfacial elasticities. Experiments are designed to lead ultimately to better data and theory on interfacial fluid properties which may then be used to control dynamic rate processes in practical applications. The specific aims of the proposed research are as follows: (1) To determine surface shear viscosity of surfactant films as function of shear rate and surface age. This will be accomplished by measuring the viscous resistance to shear flow in the plane of the interface containing surface-active materials and by using the new interfacial shear viscometer developed, designed, and already tested in PI's laboratory. (2) To determine the state of surface films in terms of packing characteristics, surface tension and surface excess concentration. Surface viscosity of surfactant films at gas-liquid interfaces will be related to their compactness and packing characteristics. (3) To determine interfacial shear viscosity at liquid-liquid interfaces from flow measurements at appropriate liquid- gas interfaces only. (4) To investigate the surface dilatational properties of surfactant films. It is planned to determine and correlate both the surface shear viscosity and the dilatational properties for the same monolayer.

SUPPORTED BY U.S. Natl. Science Foundation

13. GEOPHYSICS

Includes Aeronomy; Upper and Lower Atmosphere Studies; Oceanography; Cartography; and Geodesy. For Related Information See Also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

13.0001, WATER RESOURCES PLANNING FOR RIVERS DRAINING INTO MOBILE BAY
G. APRIL, Univ. of Alabama, School of Engineering, *Tuscaloosa, Alabama* 35486 (160-75-98)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

13.0002, ANALYSIS OF SATELLITE DATA FROM THE MAGNETOSPHERE AND COMPARISON WITH GROUND-BASED DATA
T.W. SPEISER, Univ. of Colorado, School of Arts, *Boulder, Colorado* 80304 (385-36-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

13.0003, AERIAL SURVEILLANCE SPILL PREVENTION SYSTEM
R.I. WELCH, Earth Satellite Corporation, *Washington, District of Columbia* 20036 (72P20634)

This project shall determine the feasibility of utilizing remote sensing aerial reconnaissance and photo or multispectral interpretation techniques to locate and identify potential spill sources in the San Francisco Bay area.

SUPPORTED BY U.S. Environ. Protect. Agency - O.O.W.P.

13.0004, ATMOSPHERIC PHYSICS AND DYNAMICS
R.M. GOODY, Harvard University, School of Arts, *Cambridge, Massachusetts* 02138

This proposal is for a broadly based program of research in the atmospheric sciences. The projected program includes activities in planetary observations, planetary aeronomy, terrestrial aeronomy, planetary dynamics, and terrestrial meteorology and climatology. Most of the work will be theoretical.

SUPPORTED BY U.S. Natl. Science Foundation

13.0005, SNOW DEPTH - WATER EQUIVALENT AND COMPARABLE ROOF LOADING
T.L. HANSON, Montana State University, Agricultural Experiment Sta., *Bozeman, Montana* 59715 (MONB00114)

Objective: Feasibility of using natural radiation for measuring snow water equivalent using airborne sensing equipment. Obtain data for correlation between snow accumulation on the ground and that which can be expected on roofs.

Approach: Select a site with past data on snow water equivalent to establish attenuation of natural radiation. If necessary, enhance background radiation with naturally-occurring materials. Make flights throughout the snow season to obtain snow water equivalent data which can be checked against data obtained by Soil Conservation Service. A low-cost building will be constructed in the immediate vicinity of the area to be used for airborne measurement of snow accumulation on the ground, and measurement of snow load on the roof will be made throughout the winter season.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

13.0006, NEAR-SHORE STUDY OF EASTERN LAKE ONTARIO, IFYGL
R.B. MOORE, State University of New York, School of Arts, *Oswego, New York* 13126 (72P16402)

The objectives of this program are twofold. First, it will provide baseline data through repetitive sampling of water quality, plankton biomass, distribution of benthic organisms and Cladophora. This will form a basis from which changes in the Lake can be measured. Secondly, near-shore processes will be examined in detail, especially at the mouths of the Oswego and Black Rivers taken along fifteen lines ten km apart from Rochester to Stoney Point, New York. Three stations are located on each line, 0.5, 4.0 and 8.0 km from shore. Cruises will be made every two weeks from April 1 through November 30, 1972. Additional cruises will be made April 1 through June 30, 1973 on the same schedule and stations as above. Zooplankton and phytoplankton will be collected for population and species determination; chlorophyll a, temperature, dissolved oxygen and pH will be determined continuously. Benthic samples will be taken seasonally to determine changes in benthic populations. All organisms will be treated to statistical analysis. Relationships between phytoplankton, primary productivity, zooplankton populations and their predators will be examined by a series of flights using a Barnes PRT-5 infrared thermometer mounted on a light aircraft. Ground truth information will be made simultaneously with these flights. An effort will be made to determine the effects of the thermal bar on biological processes.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

13.0007, AIRGLOW AND AURORAS IN PLANETARY ATMOSPHERES
T.M. DONAHUE, Univ. of Pittsburgh, School of Arts, *Pittsburgh, Pennsylvania* 15213

This grant provides funding to the group at the University of Pittsburgh under Dr. Thomas Donahue for a wide varying attack on problems of aurora and airglow. Included are theoretical studies, ground, rocket, and satellite based observations and laboratory measurements.

SUPPORTED BY U.S. Natl. Science Foundation

13.0008, UPPER ATMOSPHERE EXCITATION
K.C. CLARK, Univ. of Washington, School of Arts, *Seattle, Washington* 98105

This is a proposal for the continuing support of the program of laboratory and field aeronomy studies which is being carried out by the principal investigator and research group at the University of Washington. Its subject of Excitation Processes of the Upper Atmosphere brings together several related investigations. These studies aim at problems in the understanding of how specific energetic particles and photons, known in the upper atmosphere, transfer excitation to atmospheric constituent gases and produce radiation.

This program contains interacting areas of effort. Within the category of laboratory aeronomy are the topics of fast coincidence techniques in specific collisional excitation by fast ions and atoms, absolute coincidence photometry of laboratory reference reactions, and atomic absorption measurements in the extreme ultraviolet. A strong interaction between laboratory and field studies is maintained through the development of new optical instrumentation for spectrum intensification, high resolution, and spectrometric triangulation and also through auxiliary education and research activities in aeronomy in the Northwest. The category of field aeronomy centers on triangulation measurements and analyses of auroral spectra at mid latitudes, with special emphasis on SAR arcs, Hydrogen arcs, and the relation of source and excitation processes for these and other auroral emissions.

SUPPORTED BY U.S. Natl. Science Foundation

14. INSTRUMENTATION AND PHOTOGRAPHY

Includes Design, Installation, and Testing of Instrumentation Systems; Gyroscopes; Measuring Instruments and Gages; Recorders, Transducers; Aerial Photography; and Telescopes and Cameras.

14.0001, INSTRUMENT DEFINITION STUDY FOR LST
G. NEUGEBAUER, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (188-78-56)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0002, MEASUREMENT TECHNIQUES FOR CONTROL SYSTEM EVALUATION - TOTAL GAS VOLUMETRIC FLOW RATE
C.A. FLEGAL, T R W Incorporated, *Redondo Beach, California* 90278 (72P20148)

This program is for the design, development, and demonstration of a technique or techniques to continuously measure the total volumetric gas flow rate in process streams. The developed devices must be able to contend with high turbulence and non-uniform velocity profiles in particulate laden gas streams (up to 15 grains per standard cubic foot). Emphasis will be placed on unattended long term (one year or more) use. Specific operational conditions to be encountered are: Temperature (0 to 400 degrees F), Gas velocity (5 to 100 ft/sec.), Humidity (10% droplet laden), Corrosive gases (100 to 3000 ppm SO2; 500 ppm NOx), Particulate (0.02 to 15 grains/scf), Flow stream size (up to 40 ft. diameter), Flowrate (up to 10-6 scfm). The development of such a device will greatly reduce the effort required to measure volumetric flow rate by manual pilot traversal. Additionally, the resulting data will be continuous rather than periodic as in the past. This continuous volumetric gas flow rate data will be combined with continuous pollutant monitoring and used to evaluate the efficiency of various control devices on full scale equipment, perform material and heat balance calculations, and evaluate the economics of pollutant removal. The program will start in October, 1972 and be completed in November, 1973.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

14.0003, LOW RESOLUTION SPECTROGRAPH FOR THE LARGE SPACE TELESCOPE
E.A. BEAVER, Univ. of California, Graduate School, *San Diego, California* 92038 (188-78-58)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0004, RAPID QUALITY CONTROL OF PHOTOGRAPHS
S.H. LEE, Univ. of California, Graduate School, *San Diego, California* 92038 (310-40-39)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0005, HIGH RESOLUTION SPECTROGRAPH OF LARGE SPACE TELESCOPE
C.F. LILLIE, Univ. of Colorado, School of Arts, *Boulder, Colorado* 80304 (188-78-58)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0006, ELECTRON METALLOGRAPHY
D. BALLARD, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

Reasons for starting or progress last year: To obtain microstructural and chemical information from bulk materials under investigation by the use of scanning and transmission electron microscopy. Characterization studies will be conducted on pollution particulates, on metals after corrosion, and on aircraft component failures. Test and standard samples will be developed to measure instrument performance.

Approach: Scanning electron microscopy allows the rapid examination of bulk materials without the need of special specimen preparation. The SEM resolution of 250A and attached x-ray spectrometer gives surface microstructures and composition details that are correlated with optical microscopy and electron probe analysis. Application of the transmission microscope to carefully prepared specimens of the bulk material can resolve

details of microstructure to 15A or less. Specimen preparation and manipulation continues to be the predominant problem in obtaining both rapid and accurate observation of microstructure. Improvements and modifications to the transmission electron microscope and SEM are designed and employed in the studies.

Expected results: Continuing support of research programs as requested. Development of new and modified microscopy techniques is appropriate. Efforts will be continued on developing test materials and methods for resolution standards and magnification standards for the SEM.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

14.0007, DEVELOPMENT OF AN ALPHA SCATTERING INSTRUMENT FOR HEAVY ELEMENT DETECTION IN SURFACE MATERIALS
A.L. TURKEVICH, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (141-93-02)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0008, NEUTRON AND GAMMA-RAY FLUX IN THE ATMOSPHERE
J.A. LOCKWOOD, Univ. of New Hampshire, School of Liberal Arts, *Durham, New Hampshire* 03824

This grant supports a program to fly on a series of balloon flights a neutron and gamma-ray detector capable of measuring the fluxes, energy spectra, and angular distributions in the energy intervals from 2-50 MeV and 1-15 MeV respectively. The detector, which is being completed under a current NSF grant, uses a time at flight measurement between two banks of liquid scintillators. The goal of the research will be to understand better the source of energetic particles in the Van Allen belts.

SUPPORTED BY U.S. Natl. Science Foundation

14.0009, LABORATORY DEVELOPMENT AND FIELD EVALUATION OF PROBE TIP AND BOUNDARY LAYER DILUTION SYSTEM
J.B. HOMOLYA, U.S. Environ. Protection Agcy., Natl. Environ. Research Center, *Durham, North Carolina* 27711 (72P18321)

A possible approach for source emission measurement is the concept of interfacing ambient air monitors to stacks with dilution devices. We have developed several prototype systems in our laboratories for this purpose. Prototype design has varied from mechanical approaches to probe-tip dilution and/or extraction techniques. The program was initiated in 7/1/72 and several designs are now undergoing field tests. The project will be ongoing through the fiscal year.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

14.0010, DISSOLVED CHLORIDE AND AMMONIUM IONS - MINIATURE ELECTRODES FOR IN SITU WATER QUALITY MONITORING
C.C. LIU, Univ. of Pittsburgh, School of Engineering, *Pittsburgh, Pennsylvania* 15213 (770-18-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0011, LOW RESOLUTION SPECTROGRAPH FOR THE LARGE SPACE TELESCOPE
R.E. NATHER, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (188-78-58)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0012, STUDY OF THE USE AND DESIGN CHARACTERISTICS OF VISIBLE AND ULTRAVIOLET INTERFERENCE SPECTROMETERS FOR THE LARGE SPACE TELESCOPE
F.L. ROESLER, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (188-78-58)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0013, DESIGN AND DEVELOPMENT OF A NET FLUX RADIOMETER
J.A. WEINMAN, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (186-68-63)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

14.0014, DEVELOPMENT OF A PROCESS FOR THE ATTITUDE DETERMINATION OF A HIGH ALTITUDE BALLOON PAYLOAD SYSTEM
N.J. NIGRO, Marquette University, School of Engineering, *Milwaukee, Wisconsin* 53233 (176-21-31)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

15. MACHINE ELEMENTS AND PROCESSES

Includes Bearings, Seals, Pumps, and Other Mechanical Equipment; Lubrication, Friction, and Wear; Manufacturing Processes and Quality Control; Reliability; Drafting; and Materials Fabrication, Handling, and Inspection.

15.0001, MICROSTRUCTURE AND HIGH TEMPERATURE PROPERTIES
J.A. ROBERSON, U.S. Air Force, Aerospace Research Labs., *Dayton, Ohio*

AF function - advanced aerospace vehicles. Deficiency - strength and lifetime of components at elevated temperatures. Research - improved microstructures. How research contributes - changes in materials processing to produce more favorable microstructures could affect the strength and reliability of many structural materials.

Various metal working techniques (i.e. forging, swaging, powder metallurgy) will be examined with the goal of determining methods for producing optimum mechanical properties, structual uniformity, and minimum costs.

Supporting agency address information: Aerospace Research Laboratory ll, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

16. MASERS

Includes Applications of Masers and Lasers. For Basic Research See: 26 Physics, Solid-state.

16.0001, FEASIBILITY STUDY OF THE USE OF RESONANCE SCATTERING FOR THE REMOTE DETECTION OF POLLUTANTS IN STATIONARY SOURCE EMISSIONS
M.E. MACK, United Aircraft Corporation, *Hartford, Connecticut* 06118 (72P20160)

The purpose of the subject contract is to determine the feasibility of using resonance scattering from a tunable laser to remotely detect pollutants emitted by stationary sources. A particular goal of the study will be to determine which form of resonance scattering, such as fluorescence or resonance Raman, is most sensitive and specific for pollutant monitoring. The contractor, as an independent institution and not as an agent of the government, will conduct an analytical and experimental evaluation of the various types of resonance scattering which could be used to measure the concentration of pollutants emitted by stationary sources such as a power plant smoke stack. The experimental evaluation will be confined to laboratory measurements. The contractor will use existing tunable laser source and detector systems. The principal pollutant gases of interest are NO and SO2. Their concentrations in coal fired power plant effluents are typically 400 plus or minus 150 and 1000 plus or minus 500 ppm, respectively. It is assumed that the scattering area is close to the smoke stack exit, and that ranging is not necessary. The degree to which an absolute concentration measurement can be made will be evaluated. Potential interferences from quenching, scattered sunlight, and laser radiation scattered by other effluent con-

stituents, such as N2, CO, H2O, CO2, particles, etc. shall be examined both analytically and experimentally. As a result of the above studies, the contractor will recommend a program for field evaluation of the most suitable form of resonance scattering for stationary source pollutant monitoring.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

16.0002, LIGHT SCATTERING PROPERTIES OF POLLUTED WATER
W.J. THALER, Georgetown University, School of Arts, *Washington, District of Columbia* 20007 (72P00436)

The general objectives of the project are the experimental and theoretical determination of the optical scattering properties of water as modified by the presence of pollutants. The specific first year objective is the experimental determination of the total and the differential scattering-cross section of solutions of algae in water as a function of frequency of the incident light and the algal concentration. Future objectives are the evaluation of the effects of particle size, shape and concentration on the angular distribution and polarization of scattered light and application of laser Brillouin and Raman scattering techniques to the determination of pollutants in water.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

16.0003, DATA PROCESSING TECHNIQUES IN SUPPORT OF LASER PROPAGATION
M.R. WEISS, Fed. Scientific Corporation, *New York, New York* 10027 (F30602-72-C-0373)

AF function - surveillance, communications and reconnaissance. Deficiency - information is required on the effect of atmospheric turbulence on the propagation of optical signals. Research- development of data processing techniques and interface hardware applicable to laser propagation measurements. How research contributes- this effort will provide the means for reducing laser propagation data which in turn will be used to develop predictive models for atmospheric effects on optical signals.

This contractual effort will provide 'in-house' data processing capabilities applicable to laser propagation data. The mission objective is to evaluate theoretical models and furnish engineering data on the effects of atmospheric turbulence on the accuracies of optical pointing and tracking systems. This contract is a natural extension of work performed under contract F30602-71-C-0007 and will further develop 'in- house' capabilities to acquire and process laser propagation data. An example of one of the requirements under this contract is to provide an on-site program (real time) to continuously compute variances which can determine when to begin and when to end an experimental run. Other experimental variables must be monitored in a similiar fashion to minimize the collection of inappropriate data.

Supporting agency address information: Rome Air Development Center, OCS, Griffiss AFB, N.Y. 13440.

SUPPORTED BY U.S. Dept. of Defense - Air Force

16.0004, OBTAIN HIGH-RESOLUTION LABORATORY SPECTRA OF SELECTED GASEOUS POLLUTANTS
H.M. BARNES, U.S. Environ. Protection Agcy., Natl. Environ. Research Center, *Durham, North Carolina* 27711 (72P18328)

The purpose of this work is to obtain laboratory spectra of various pollutants when such data is not available in the published literature. One aspect of this effort will be to set up a tuneable laser diode system to obtain ultra-high resolution spectra and study the effects of pressure broadening.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

16.0005, DEVELOPMENT OF RANGE SQUARED AND OFF-GATING MODIFICATIONS FOR A LIDAR SYSTEM
G. BETHKE, General Electric Company, *Philadelphia, Pennsylvania* 19123 (72P20092)

A lidar technique has been developed for remote measurement of the transmittance of smokestack plumes. A standard pulsed lidar is used for the measurement where atmospheric backscatter of the outgoing pulse is observed as a function distance. The transmittance of a plume is determined by firing the laser pulse through the plume and measuring the discontinuity between the atmospheric backscatter of the pulse just in front of and behind the plume. Extensive testing of the system has shown that the accuracy of the measurement is affected by the intense pulse backscattered by the plume and that data reduction is complicated by the inverse square range dependence of the signal return. Off-gating the photomultiplier detector of the lidar receiver when the backscatter from the plume is received has improved but not eliminated the error. This project is designed to eliminate the lidar error in measuring plume transmittance due to plume backscatter of the laser radiation and to linearize the backscattered signal display with respect to range. The study is designed (1) to eliminate the dominant source of error in the remote measurement of the transmittance of smokestack plumes using lidar, and (2) to improve the data presentation of the lidar transmittance measurement.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

16.0006, HIGH RESOLUTION MOLECULAR SPECTROSCOPY
S.R. POLO, Penn. State University, School of Science, *University Park, Pennsylvania* 16802

Drs. McCubbin and Polo will investigate the fluorescence spectra of molecules such as NO2 with excitation by a tunable dye laser to obtain information about excited electronic states. They will study Raman vibrational spectra and intensities of simple polyatomic molecules. Using high resolution infrared they will also study molecules for which vibration-rotation interaction effects are pronounced, such as HNCO and SiH3D. Quantitative spectroscopy including studies of strengths, widths, etc. of infrared lines is another topic of interest. Theoretical studies will also be included. This work is a continuation of that currently supported by Foundation grant GP-14485.

SUPPORTED BY U.S. Natl. Science Foundation

17. MATERIALS, METALLIC

Includes Cermets; Corrosion; Physical and Mechanical Properties of Materials; Metallurgy; and Applications As Structural Materials. For Basic Research See: 06 Chemistry. For Related Information See Also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

17.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - STRENGTH AND TOUGHNESS OF TITANIUM ALLOYS
A.W. SOMMER, Rockwell International Corp., *Los Angeles, California* 90009 (N00014-67-C-0439)

Titanium alloys are used in deep submergence hulls, blading in turbojet engines, airframes, and hydraulic lines. Titanium's low density, one-half that of steel, offers significant weight savings in vehicles. This research project is aimed at providing needed strength and toughness improvements in titanium alloys.

The effect of hydrogen and oxygen on dislocation mobility and fracture toughness will be determined in several alpha titanium alloys. An attempt will be made to enhance the high temperature properties of alpha titanium by additions of gallium and bismuth. Alpha phase precipitation will be studied in metastable beta alloys with emphasis on developing fine dispersions of alpha.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

17.0002, NAVY VEHICLE DESIGN AND CONSTRUCTION - THE EFFECT OF THERMOMECHANICAL TREATMENT ON THE STRENGTH AND MICROSTRUCTURE OF STEEL
T.J. KOPPENAAL, Philco Ford Corporation, *Newport Beach, California* 92663 (N00014-70-C-0223)

Since alloy steels are used widely in the navy in such applications as ship hulls, aircraft landing gears, support structures, bearings, etc., new processing techniques for steel that offer increased mechanical strength and toughness are of great interest. This research effort examines a thermomechanical treatment which appears to accomplish this goal.

Two model alloys of iron-nickel steel (one low in carbon, one medium in carbon) will be plastically deformed in the ferritic condition and then austenitized. The effects of deformation and phase cycling on the structure and tensile properties of reverted austenites will be determined. These austenites will later be transformed to martensite to show any carry-over in strength that might result from the thermomechanical treatments. Transmission electron microscopy and X-ray analysis will be used to characterize the microstructures of the steels.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

17.0003, ASPECTS OF STRESS CORROSION
W.A. TILLER, Stanford University, School of Engineering, *Palo Alto, California* 94305 (AF-AFOSR-2206-72)

The demanding requirements of high performance aerospace vehicles make clear the need for materials with premium mechanical properties and resistance to environmental degradation. A solid, which by its intrinsic strength, its configuration, and mass, should be dependable, can, never- the-less, fail catastrophically given a specific set of environmental conditions. Stress corrosion cracking is the name given a broad class of such failures, and its fundamental nature is not yet understood. The objective of this research is to develop a new approach to stress corrosion and the attendant cracking that accompanies it. Further, the objective is to theoretically analyze, in a quantitative way, the response of a surface to stress and environment changes and to experimentally determine the actual interface response in well-defined and well-controlled situations. It is designed to acquire basic information about the important processes involved in the complex phenomenon of stress corrosion, and, by correlating theory and experiment, to build a structure of understanding that will allow quantitative predictions to be made. The results of this study are expected to have implications on the role surfaces play in stress corrosion cracking and to provide a framework for reliably controlling the response of any surface to stress.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd, Arlington, Va. 22209.

SUPPORTED BY U.S. Dept. of Defense - Air Force

17.0004, OXIDE SCALE ADHERENCE MECHANISMS
F. PETTIT, United Aircraft Corporation, *Hartford, Connecticut* 06118 (F33615-72-C-1702)

AF function - high temperature propulsion materials. Deficiency - physical property degradations of alloys due to oxidation at high temperatures. Research - the adherence mechanism(s) of alumina on nicral and cocral alloys with and without tytrium additions will be determined under normal oxidizing conditions and in the presence of applied tensile and compressive loads. How research contributes - an understanding of the affect on scale adherence of the alloy structure and composition and the resulting oxide growth mechanisms and morphology can lead to controlling the adherence of oxide scales and thereby to the use of desirable alloys previously discounted because of poor scale adherence. The evaluation of the effect of applied stress during oxidation may well lead to a better understanding of alloy behavior during actual use, since in practice most high temperature alloys are subjected to loads during exposure to the degrading environment.

Supporting agency address information: Aerospace Research Laboratory ll, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

17.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - MECHANISMS OF HYDROGEN EMBRITTLEMENT IN METALS AND ALLOYS USED IN NAVAL STRUCTURES
H.K. BIRNBAUM, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (N00014-67-A-0305-0020)

This research undertakes to clarify the mechanisms by which hydrogen can embrittle metals and alloys, such as those used for naval aircraft and ship structures.

The investigators are to study crack initiation and propagation in niobium-hydrogen and iron-hydrogen alloys. Temperatures and hydrogen content are to be varied so that cracking may be studied in alloys both with and without the presence of precipitated hydrides. Acoustic emission techniques are to be used to follow crack growth and deuterium will be used as a substitute for hydrogen in certain cases to check diffusion constants and rates. Also, oxygen doping (which alters the diffusion rate of hydrogen in niobium) will be used to determine the effect of hydrogen diffusion rate on crack growth.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

17.0006, NAVY ENVIRONMENT--EFFECT OF ENVIRONMENT ON THE MECHANICAL BEHAVIOR OF METALS
R.M. LATANISION, Martin Marietta Corporation, *Baltimore, Maryland* 21227 (N00014-70-C-0255)

The objective of this work is to determine and explain the effect that environment, such as the marine environment, has on the mechanical behavior (hardness, flow resistance, etc.) of metals and alloys used in naval aircraft and shipboard components.

The deformation characteristics of metals in various environments are being studied as a function of potential at the metal interface; hardness, yield strength and strain hardening determinations are being used to evaluate deformation behavior. Analyses of slip modes by etch pit and X-ray technique are being carried out.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

17.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - EFFECTS OF CYCLIC PHASE TRANSFORMATION TREATMENTS ON THE PROPERTIES OF STEEL
S.A. KULIN, Manlabs Incorporated, *Cambridge, Massachusetts* 02139 (N00014-70-C-0039)

The proposed research is aimed at improved reliability and performance of small steel parts such as bearings, pins, bolts, springs, etc, used in a variety of navy and marine corps components. The investigators will attempt to refine the structure of steel, and thereby raise its strength and toughness, by using cyclic phase transformations.

The cyclic treatment to be employed here is the austenite-to-martensite phase transformation, which will be induced repeatedly by thermally cycling the steel between high and low temperatures. The researchers will determine the effect of the cycling on the structure and mechanical properties of three commercial steels, and develop a theoretical approach for understanding the structure-property relationship.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

17.0008, STUDY INTO EFFECTS OF OXIDIZED TITANIUM ON HYDROGEN TRANSPORT IN TITANIUM AT LOW TEMPERATURES
D.L. JOHNSON, Univ. of Nebraska, School of Engineering, *Lincoln, Nebraska* 68508 (501-21-21)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

17.0009, NAVY VEHICLE DESIGN AND CONSTRUCTION - DISPERSION STRENGTHENED METAL ALLOYS
G.S. ANSELL, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (N00014-67-A-0117-0011)

The navy has a need for high strength, high toughness metal alloys for use in a wide variety of components ranging from pumps and compressors to aircraft support structure and jet engine parts. Improved alloys would result in greater reliability, better performance and/or decreased weight. In this research the investigator will explore mechanisms of strengthening in metal alloys, with emphasis on martensitic steels.

Strengthening mechanisms in martensitic steels will be examined from the following viewpoints: effect of austenite shear strength on formation of the hard martensite; effect of volume strain on the formation of martensite; and the cause of the strength differential in maraging steels. Values of strength of interfaces between second phase particles and the surrounding matrix will be determined in metal alloys using strain contrast experiments in the transmission electron microscope.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

17.0010, INFLUENCE OF MICROSTRUCTURE AND SECOND PHASES ON FRACTURE TOUGHNESS
G.T. HAHN, Battelle Memorial Institute, *Columbus*, *Ohio* 43201 (F33615-71-C-1915)

AF function - advanced aerospace vehicles. Deficiency - reliability and failure of structural materials. Research - determine how microstructure and interfaces affect fracture behavior. How research contributes - changes in materials processing to produce more favorable microstructures could markedly affect the strength and reliability of many structural materials.

The fracture process in typical alloys will be examined in considerable detail in order to identify mechanisms of crack nucleation and growth.

Supporting agency address information: Aerospace Research Laboratory ll, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

17.0011, INFLUENCE OF SUBSTRUCTURE ON THE PROPERTIES OF METALS
B.A. WILCOX, Battelle Memorial Institute, *Columbus*, *Ohio* 43201 (F33615-71-C-1714)

AF function - advanced aerospace vehicles. Deficiency - reliability and failure of structural materials at high temperatures. Research - determine the benefit and stability of substructures at stress and temperature. How research contributes - minor changes in standard thermomechanical treatments to produce stable substructures could markedly affect the stress/temperature use limits of many materials.

Thermomechanical treatments designed to improve either the elevated temperature strength or stability of various aluminum alloys are checked to determine their value as regards creep resistance. The mechanisms of substructure breakdown under creep conditions are determined.

Supporting agency address information: Aerospace Research Laboratory ll, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

17.0012, INTERNAL STRUCTURE AND PHYSICAL PROPERTIES OF CERAMICS AT HIGH TEMPERATURES
W.C. TRIPP, Systems Research Labs. Inc., *Dayton*, *Ohio* 45432 (F33615-71-C-1841)

AF function - high temperature propulsion materials, thermal protective materials and power generator materials. Deficiency - failure of materials to perform at high temperatures due to oxidation, loss of strength or lack of requisite physical, chemical or mechanical properties. Research - studies of the kinetics of the degradataion of materials exposed to reactive atmospheres will be combined with studies of the microstructure and morphology of the alloy and the reaction products. The relationship of the defect structure and microstructure of selected materials to their physical properties and to processes such as high temperature creep will be determined under conditions of thermodynamic equilibrium. How research contributes - an understanding of the fundamental transport mechanisms active in materials to be used for various high temperature applications is essential if significant long range improvements are to be made. Once the mechanisms are known, modification in material composition, structure or surface conditions can be made in a scientific manner to improve the high temperature behavior of the material.

The kinetics of the various oxidation studies will be determined using sophisticated thermogravimetric facilities and these data will be combined with detailed microstructural analyses to define the oxidation mechanisms. Solid state cell reaction will be made and the results analyzed using the microprobe to determine the concentration profiles so that interdiffusion coefficients can be determined. Appropriate high temperature mechanical properties tests will be used to evaluate the mechanical behavior of ceramics and alloys in high temperature hostile environment. Emphasis will be placed on relating the behavior to intrinsic properties of the particular material.

Supporting agency address information: Aerospace Research Laboratory ll, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

17.0013, ADVANCED COMPOSITE STRUCTURES - COMPUTER STUDIES FOR ADVANCED USAF AIRCRAFT
T.J. MUHA, U.S. Air Force, Flight Dynamics Lab., *Dayton*, *Ohio* 45433

The utilization of advanced composite materials is necessary to meet the requirements of advanced USAF aircraft, however, these materials cannot be utilized in the absence of sophisticated design techniques. The purpose of this program is to enhance the capability of the branch in design techniques by acquiring and/or modifying computer programs and developing an expertise with these programs. The results of the program will then be applied to the design of aircraft structures which use advanced composite materials.

Computer programs including, but not limited to, NASTRAM, MAGIC, BONJO, and STEPS4 will be studied, tested, and evaluated for use by the branch for future and on-going programs.

Supporting agency address information: AF Flight Dynamics Laboratory, FBC, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

17.0014, DEFORMATION CHARACTERISTICS OF SLOWLY GROWING FATIGUE CRACKS
J. LANKFORD, Southwest Research Institute, *San Antonio*, *Texas* 78228 (F44620-73-C-0040)

Current and future needs of the air force depend upon significant advances in structural materials. The synthesis of new and improved metals as well as the fundamental understanding of the behavior and performance of such metals are essential to superior operation in the aerospace environment. In order to formulate valid and general predictive relations describing fatigue crack growth under varying thermal and environmental conditions, knowledge of crack tip strain fields and deformation modes are needed. The objective of the proposed research is to determine the interrelation between crack growth rate and plastic zone characteristics and the way in which environment, temperature, and load history alter the plastic characteristics. This objective will be accomplished by mapping the plastic zones about the tips of fatigue crack in notched, thin sheet specimens. Cracks will be grown under carefully controlled environmental and thermal conditions. Measurements will be carried out primarily by analysis of selected area electron channeling patterns, supplemented by scanning electron microscopy and replica transmission electron microscopy. This research will result in increased understanding of the mechanisms of crack extension, and improvement of existing plasticity correction factors (to include environmental and thermal terms) used in crack growth laws based on linear elastic-fracture mechanics.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd, Arlington, Va. 22209.

SUPPORTED BY U.S. Dept. of Defense - Air Force

17.0015, HOT CORROSION OF GAS TURBINE ALLOYS
J. STRINGER, Univ. of Liverpool, *Liverpool*, *England*, *United Kingdom* (AF-AFOSR-2388-72)

AF function - materials for gas turbine engine application. Deficiency - insufficient knowledge of the corrosion mechanisms existent within the gas turbine engine environment to describe the proper metal alloy combinations for engine applications. Research - investigate the corrosion mechanisms acting on the

typical nickel-base superalloy system. On the basis of results from this study, suitable model alloy systems will be constructed to determine hot corrosion effects on alloy components both separately and in combination. How research contributes - data will provide information which contributes directly to next generation gas turbine engine material systems.

It is proposed to perform research in the following areas: 1. The development of a thermogravimetric apparatus based on the principle of the dean apparatus (to introduce very low salt concentrations, reproducibly), and its evaluation for the study of hot corrosion, and 2. The extension of the present technique of the study of part process in relatively complex situations which model, but are more tractable than, the actual problem, to nickel-base superalloy systems.

Supporting agency address information: European Office of Aerospace Research and Development, FPO, New York 09510.

SUPPORTED BY U.S. Dept. of Defense - Air Force

18. MATERIALS, NONMETALLIC

Includes Corrosion; Physical and Mechanical Properties of Materials (e.g., Plastics); and Elastomers, Hydraulic Fluids, Etc. For Basic Research See: 06 Chemistry. For Related Information See Also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

18.0001, SURVEILLANCE - PRESSURE SENSITIVE PLASTICS

M.G. BROADHURST, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

The navy is a large user of piezoelectric (pressure-sensitive) devices for detecting acoustic signals. Certain plastics have been found to exhibit piezoelectric activity and have the advantage that they can be formed into thin films and other shapes which are impractical for ceramic piezoelectrics. It is the purpose of this research to understand the piezoelectric phenomenon in plastic materials and to find means for enhancing it to make practicable their use in instruments for detecting pressure changes.

A suitable theoretical model for piezoelectricity in polymers will be developed and experimentally tested. A relationship will be sought between molecular structure and motions and the piezoelectric phenomenon. An attempt will be made to optimize the piezoelectric effect. An investigation of the relationship of pyroelectricity (thermal effects) to piezoelectricity (mechanical effects) is part of this research.

Supporting agency address information: Office of Naval Research 472, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

18.0002, MISCELLANEOUS SOLAR LABORATORY PROJECTS

C.A. MORRISON, Univ. of Florida, School of Engineering, *Gainesville, Florida* 32601

Description: This project is intended to determine the solar-optical properties of window materials such as glass, shading devices, draperies, etc., and to determine a 'shading coefficient' for these materials. The U-F-ASHRAE Solar Calorimeter is the principal research tool. This is augmented by a DK-2 Spectrophotometer with reflective attachments and by various types of sensing devices. The overall heat transfer coefficient of sample glass plates, panels, and opaque materials may be determined with a high degree of accuracy using the 'Hot Box-Cold Box' facility and its associated instrumentation. Over the past eight years work has been done for some 30 different companies.

SUPPORTED BY No Formal Support Reported

18.0003, STRUCTURE-PROPERTY RELATIONS IN POLYMERS

B. HARTMANN, U.S. Navy, Ordnance Laboratory, *Silver Spring, Maryland* 20910

Establish unifying concepts in polymer physics that relate the chemical and physical structure of polymers and composites to their bulk properties. Use these concepts to predict materials behavior under long- term loading, severe environments, shock loading, and other conditions typically required of naval mines, torpedoes, submarines, ammunition, missile reentry bodies, etc.

Specific heat - Determine specific heats in the differential scanning calorimeter over broad temperature ranges extending from as near absolute zero as possible to about 500 degrees C. Acoustic properties - Relations will be sought between sound absorption, as a function of temperature, and polymer parameters such as molecular configuration, polymer chemistry, glass transition temperature, and molecular weight distribution. Mechanical spectroscopy - Determine modulus and damping characteristics of plastics over a wide temperature range, essentially at a frequency of 1 Hz using a torsional pendulum and a torsional braid analyzer. Transitions in the polymers will be determined as a function of polymer structure and molecular weight.

Supporting agency address information: Office of Naval Research 472, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

18.0004, HIGHLY HALOGENATED ORGANIC AND ORGANOMETALLIC MATERIALS AND METALLACYCLOPROPANES

D. SEYFERTH, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (AF-AFOSR-2204-72)

Air Force flight operations require new and improved materials to serve a wide variety of critical functions in advanced aircraft and missiles. Fluids and lubricants are needed as hydraulic fluids, coolants, engine oils, and gyro fluids. Seals and sealants serve indispensable needs for fuel, liquid and air retention, and expulsion bladders in liquid rocket systems. Polyhalogenated organics, particularly fluoro-organic compounds, are among the most promising in this area. This research involves the preparation and studies of the properties of polyhalogenated intermediates which will be useful in the synthesis of improved lubricants, seals, and sealants. Research is proposed on the chemistry of halomethylmercury compounds (especially those containing fluorine) suitable for use as divalent carbon transfer agents. New carbenes will be sought and new carbene chemistry will be investigated. The chemistry of halogenated cyclopropanes will be studied. The chemistry of silacyclopropanes will be developed and other stable metallacyclopropane systems will be sought.

Supporting agency address information: AF Office of Scientific Research, 1400 Wilson Blvd, Arlington, Va. 22209.

SUPPORTED BY U.S. Dept. of Defense - Air Force

18.0005, MECHANICS OF BRITTLE MATERIALS

E.M. LENOE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172

To complete materials characterization, evaluation of test techniques, and to provide improved design and analysis procedures for brittle materials. The particular materials are leading candidates for gas turbine applications.

Recent improvements in properties of hot pressed silicon carbide and silicon nitride suggest the importance of detailed investigation of their behavior. In particular, Norton silicon carbide has exhibited high strength values and creep resistance at elevated temperatures. The Norton hot pressed silicon nitride designated as NC-132 has demonstrated significant tensile strength improvement. Thus the major objectives of this phase of the project will be to obtain statistical data on the stress-strain response, fracture behavior and high frequency acoustic fatigue characteristics of these materials. Successful development of highly efficient (very high temperature) vehicular and electric power gas turbines will rest with the ability of silicon nitride and silicon carbide to survive demanding tension creep and fatigue conditions. The fatigue loadings generally occur at high frequencies and thus this aspect of behavior ought to be further explored. Finally, the influence of thermal shock, and crack growth behavior under repeated thermal excursions will be investigated.

Supporting agency address information: AMC Materials & Mechanics Research Center, AMSMR-TM, Watertown, Mass. 02172.

SUPPORTED BY U.S. Dept. of Defense - Army

18.0006, ENVIRONMENTAL DEGRADATION OF FUELS, FLUIDS AND RELATED MATERIAL FOR AIRCRAFT
N. HODGSON, Monsanto Research Corporation, *Dayton, Ohio* 45407 (F33615172-C-1071)

To establish those fuels and lubricant properties critical to satisfactory performance in current and advanced systems. To establish the cause of operational problems related to fuels and lubricants. To develop techniques of analyses for trace fuels and lubricant constituents and fuel additives.

Development of instrumental methods of analysis, based on gas and liquid chromatography, infrared absorption, ultraviolet emission and absorption, X-ray diffraction, etc., will be stressed for analysis of organic and inorganic constituents.

Supporting agency address information: AF Aero-Propulsion Laboratory, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

18.0007, ULTRASONIC PROCEDURES FOR THE DETERMINATION OF BOND STRENGTH
J.L. ROSE, Drexel University, School of Engineering, *Philadelphia, Pennsylvania* 19104 (AF-AFOSR-2480-73)

The weight saving in air force aircraft and missiles achieved by the use of adhesive bonding can go into increased vehicle pay load. However, a reliable method of nondestructively determining the adhesive bond strength of joints is needed to eliminate possible failures. Parameters based on 'C' scan ultrasonics and ultrasonic spectroscopy will be used for the determination of the strength of adhesive bonds. The bond strength as a function of geometrical variations of various lap joints and bonded joint designs will be found. The effects of several processing variables that may affect the strength characteristics and in-service performance of the bonds will be studied. The effects of known flaws of various shapes and sizes on the strength of a joint will also be investigated. Dispersion in a three-layered system due to density gradients and thickness variations in the middle adhesive layer will be calculated to obtain a better understanding of the ultrasonic spectroscopy output.

Supporting agency address information: AF Office of Scientific Research, 1400 Wilson Blvd, Arlington, Va. 22209.

SUPPORTED BY U.S. Dept. of Defense - Air Force

19. MATHEMATICS

Includes Calculation Methods and Theory; and Numerical Analysis. For Applications See Specific Categories. For Related Information See Also: 08 Computers.

19.0001, NON-LINEAR CONTINUUM MECHANICS
A.C. PIPKIN, Brown University, Graduate School, *Providence, Rhode Island* 02912

This is a continuation of research previously supported under GP 28881A1.

A.C. Pipkin will continue his development of the mathematical theory of the mechanical response of solids and fluids, with emphasis on large deformations and history-dependent effects. This work involves formulation of constitutive equations, exact solution of problems involving unknown response functions, and development of approximate methods of solution. Particular boundary-value problems will be solved when these are directly related to the experimental determination of material properties or illustrate new methods of solution. Specific topics concern viscoelastic fluids, fiber-reinforced composites, and elastomers.

In connection with viscoelastic fluids, he will conduct a systematic theoretical search for experimentally feasible configurations involving materially steady motions, particularly steady stretching motions and analysis of configurations which might be used in the determination of the dynamic response functions for nearly viscometric flows.

In the area of fiber-reinforced composites, he will develop methods of solution of finite deformation problems, particularly axisymmetric problems, and to formulate a theory of small deformations superimposed on large that correctly accounts for singular perturbation behavior.

Analysis of experimental results concerning the effect of large stretching on the dynamic moduli of elastomers will be done.

SUPPORTED BY U.S. Natl. Science Foundation

20. METEOROLOGY

Includes Climatology; Weather Forecasting; and Visibility Studies. For Related Information See Also: 13 Geophysics; and 30 Space Sciences.

20.0001, ATMOSPHERIC PROBING USING WAVE PROPAGATION MEASUREMENTS
A.T. WATERMAN, Stanford University, School of Engineering, *Palo Alto, California* 94305

It is proposed to continue research on probing the atmosphere by making appropriate measurements on waves propagated through it. The quantities of primary concern are the turbulence parameter CN and the component of wind transverse to the path; the shape of the turbulence spectrum and the anisotropy of the turbulence may also be measured. This approach makes use of spatial filtering of the propagated waves at one or both ends of the transmission path. The waves used may be radio, optical or acoustic. The initial work utilized an existing radio (35 GHz) path set-up. More recently optical propagation measurements have been made. The proposal visualizes a continuation and expansion of each of these--including a quasi-cooperative venture with San Jose State University on the Mt. Sutro tower in San Francisco, in which they will be making direct conventional meteorological measurements. Each stage of the research program will be accompanied by computer modeling studies to optimize the approach.

SUPPORTED BY U.S. Natl. Science Foundation

20.0002, INVARIANT MODELING OF ATMOSPHERE TURBULENCE AND DIFFUSION
C.D. DONALDSON, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (72P19787)

Invariant modeling provides a new closure scheme for the Navier- Stokes equations in turbulent fluid motion. The success of this technique in predicting the structure of turbulence in a variety of classical shear flows has suggested important applications for atmospheric turbulence and diffusion. Initial tests for an atmospheric situation were made for an infinite cross-wind line source of matter in the thermally stratified lower layer of the atmosphere. Using only the mean wind and temperature profiles for the atmosphere and a predetermined scale length, the vertical dispersion of a pollutant release has been predicted within a factor of two of observed values out to distances of about two miles. The study is currently being extended to permit analysis of diffusion in an unstable surface atmospheric layer that is capped by a temperature diffusion in three spatial dimensions from a point source that is being considered together with diffusion in the Ekman spiral of the planetary boundary layer. The method of invariant modeling is also being adapted so as to include within a coupled analytical framework chemical reactions in the presence of turbulent mixing. This study will attempt to define atmospheric situations where turbulent mixing significantly affects the rate of loss of primary photochemical pollutants and the rate of production of secondary ones.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

20.0003, SUPPORT OF ATMOSPHERIC TURBIDITY NETWORK
E.C. FLOWERS, U.S. Environ. Protection Agcy., Natl. Environ. Research Center, *Durham, North Carolina* 27711 (72P18354)

Atmospheric turbidity is a measure of the extinction of light due largely to scattering with perhaps some lesser contribution from absorption by aerosols. Measurements are normalized to a vertical path through the atmosphere. Turbidity measurements by sunphotometer are now being made at 78 stations throughout the world. Fifty-two of the stations measure turbidity at wavelengths of 0.38 and 0.50 micrometers while the remaining 26 stations measure only at 0.50 micrometers. The purpose of the project is to monitor atmospheric turbidity in the U.S. as well as world wide to determine background values, seasonal, and geographical variations, and especially to expose any long term trends. The data are published every four months by the National Climatic

Center in Asheville, North Carolina. Instruments are supplied, calibrated, and maintained by the Division of Meteorology. The project was started in 1960 with about 10 U.S. stations. It grew to about 40 stations by 1965, and in 1971-1972, the remainder of the stations, mostly foreign, were activated. The idea of an international turbidity network is supported by the World Meteorological Organization. The project is expected to continue for several years.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

20.0004, HAZE FORMATION, ITS NATURE AND ORIGIN
D. MILLER, Battelle Memorial Institute, *Columbus, Ohio* 43201 (72P19909)

The objective of the program is to determine the relationships which exist between the chemical composition of light-scattering particles, the composition of the ambient atmosphere, and the attenuation of visibility in the atmosphere. Ultimately, the compositional relationships to light scattering will be used to establish the contribution of auto exhaust to urban haze. Field sampling will be undertaken in three cities - New York, St. Louis, and Los Angeles - having widely varying meteorology, emission inventories and photochemical activity. Continuous monitoring of meteorological conditions, light scattering and gas-phase composition will be performed concomitant with aerosol collections. Determination will be made of the organic and inorganic composition of airborne particles in the light- scattering size range. The ultimate purpose is to be able to determine the proportion of atmospheric haze due to auto exhaust. This will, in turn, permit a more rational choice of control options and allow assessment of the extent to which changes in automobile emissions affect visibility.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

21. NAVIGATION

Includes Guidance; Autopilots; Star and Planet Tracking; Inertial Platforms; and Air Traffic Control. For Related Information See Also: 07 Communications.

21.0001, DEVELOPMENT AND DELIVERY OF A THIRD GENERATION GYRO
UNKNOWN, Mass. Inst. of Technology, Graduate School, *Cambridge, Massachusetts* 02139 (188-78-57)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

21.0002, APPLICATIONS OF COMPUTER SPEECH RECOGNITION IN FLIGHT MANAGEMENT
R.P. PLUMMER, Univ. of Utah, Graduate School, *Salt Lake City, Utah* 84112 (504-29-02)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

22. NUCLEAR ENGINEERING

Includes Nuclear Reactors and Nuclear Heat Sources Used For Propulsion and Auxiliary Power. For Basic Research See: 24 Physics, Atomic, Molecular, and Nuclear. For Related Information See Also: 03 Auxiliary Systems; and 28 Propulsion Systems.

22.0001, DEVELOPMENT OF A THERMIONIC REACTOR SPACE POWER SYSTEM
J.W. HOLLAND, Gulf Energy & Environ. Sys. Co, *San Diego, California* 92112

Description: Direct conversion of fission heat to electric power. Connected groups of diodes operate in-pile; a reactor experiment has been defined and designed; reactors covering a spectrum of power output have been conceptually designed.

SUPPORTED BY U.S. Atomic Energy Commission

22.0002, PRACTICAL ASPECTS OF BASIC THERMIONIC CONVERSION RESEARCH
N.S. RASOR, Rasor Associates Incorporated, *Dayton, Ohio* 45429

Description: The primary objective of this project is to demonstrate analytically and experimentally that fundamental improvements in thermionic converter operation are possible which can substantially improve the design performance of electric power systems. A second objective is to put the present basic understanding of converter operation in a form that will assist engineering development and design of thermionic power systems. Past emphasis has been on the region of operation associated with compact nuclear reactors for space application. Present and future emphasis is on application to thermionic topping of central station power plants.

SUPPORTED BY U.S. Atomic Energy Commission

22.0003, ISOTOPIC POWER MATERIALS DEVELOPMENT
R.G. DONNELLY, Oak Ridge National Laboratory, *Oak Ridge, Tennessee* 37830

Description: The purpose of this program is to develop high-melting, oxidation resistant alloys for space applications of isotopic heat source capsules operating between 900 and 1300 degrees C. This requires alloys exhibiting superior performance under operational, abort, reentry, earth impact, and postimpact conditions. Potential applications are as fuel containment materials in 238PuO(2)-and 244Cm(2)O (3)- fueled thermoelectric generators, such as the multihundred Watt (MHW) generator now under development ad advanced versions of the SNAP- 19 generator as used aboard the Pioneer space probe.

SUPPORTED BY U.S. Atomic Energy Commission

23. PHYSICS, GENERAL

Includes Acoustics, Cryogenics, Mechanics, and Optics. For Astrophysics See: 30 Space Sciences. For Geophysics and Related Information See Also: 13 Geophysics. 20 Meteorology, and 29 Space Radiation.

23.0001, EXPERIMENTAL MEASUREMENTS OF THE HEAT CAPACITIES OF LIQUIDS AT HIGH TEMPERATURES
R.C. REID, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139

Long-range goal of this research is to obtain accurate experimental values of heat capacity for a number of subcooled liquids at high pressures and to correlate these data with theoretical knowledge regarding liquid structure. In this last year of a 3-year program, ten pure liquids and mixtures will be measured. New data will be correlated using recently developed analytical models. Generalized techniques to estimate high temperature liquid heat capacities are expected.

SUPPORTED BY U.S. Natl. Science Foundation

26. PHYSICS, SOLID-STATE

Includes Semiconductor Theory; and Superconductivity. For Applications See: 16 Masers. For Related Information See Also: 10 Electronics.

26.0001, FAR INFRARED LATTICE PROPERTIES OF GALLIUM ARSENIDE
UNKNOWN, Talladega College, Undergraduate School, *Talladega, Alabama* 35160 (340-00-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

26.0002, ULTRALOW TEMPERATURE STUDIES OF SUPERCONDUCTORS AND MAGNETIC ALLOYS
Y.B. KIM, Univ. of Southern California, School of Letters, *Los Angeles, California* 90007

Experimental investigations previously supported under GP-29031 will be performed to study at ultralow temperatures the properties of superconducting materials and the behavior of transition metals containing magnetic impurities. The experi-

ments will be conducted in four specific areas: (1) Microwave flux flow measurements on type II superconductors under varying conditions to compare the results with microscopic calculations based on the time-dependent Ginzburg-Landau equations; (2) The study of metallurgical defect structures in high- field superconductors in relation to the stability of supercurrents; (3) The study in non-dilute magnetic alloys of the fundamental intermoment interactions when the localized moments are dressed by the Kondo effect, and (4) The study of the Kondo effect in dilute magnetic alloys at microwave frequencies to ascertain the predicted existence of a sharp resonance in the conduction electron scattering cross section near the host metal Fermi energy.

SUPPORTED BY U.S. Natl. Science Foundation

26.0003, MAGNETISM OF SOLID FREE RADICALS AT LOW TEMPERATURES
W. DUFFY, Univ. of Santa Clara, School of Humanities, *Santa Clara, California* 95053

Research previously supported under GH-39015 will be continued. Fundamental studies of the magnetic and thermal properties of crystalline stable organic free radicals will be pursued, over the temperature range from 0.35 to 300 K. Low temperature precision calorimetry, and static and low-frequency susceptibility measurements will be performed on nonionic free radicals based on DPPH (2,2-diphenyl- l picrylhydrazyl). The high-room-temperature- conductivity complexes of the ionic radical TCNQ-(tetracyanoquinodimethan) will be investigated by the same techniques. The EPR lineshapes of regular linear chains with a high degree of interchain isolation will be studied in both the ionic and nonionic systems. EPR lineshape studies of the quadratic net system DPAN (di-p-anisylnitrosyl) will be made.

SUPPORTED BY U.S. Natl. Science Foundation

26.0004, PARAELECTRIC RESONANCE STUDIES OF INSULATORS
F.G. BRIDGES, Univ. of California, Graduate School, *Santa Cruz, California* 95060

A continuation and extension of the research on paraelectric centers which has been supported by NSF Grant GH-34649, will be made. Detailed paraelectric resonance (PER) spectra in the Kl:OH system over the range of 12-75PHz have indicated several points. First, the general features of the data can only be explained by a (110) oriented dipole model. However, strong evidence is found suggesting that the lower energy levels for this system are split into two or more multiplets separated by several hundred GHz. Finally, even if the data pertaining to the upper multiplets is neglected, the remaining data cannot be explained by the simple (100) tunneling model. The range of available microwave frequencies will be extended and the properties of the upper multiplet of energy levels will be investigated. This will be an important aid to theoretical investigations of upper multiplets and may explain some of the discrepancy observed in the ground state multiplet. The systematic study of the alkali-halide:OH systems will be continued;NaCl:OH will be investigated. New and unexpected PER spectra have been observed in the KBr:Li plus system. Previous experiments had indicated that unlike the KCl:L plus system, the lithium in KBr was on center and did not produce a paraelectric effect. The zero field splittings of this system are quite high (60Hz) and the lines have only been investigated over a very small range of frequency. Higher frequencies will be used to investigate this system and compare the observations with the existing theoretical prediction. In this investigation, we hope to understand why previous different types of experiments failed.

SUPPORTED BY U.S. Natl. Science Foundation

26.0005, LIGHT SCATTERING STUDIES OF SPIN-FLIP PROCESSES IN SEMICONDUCTORS AND OF ANOMALOUS PHASE TRANSISTORS IN INSULATORS
J.F. SCOTT, Univ. of Colorado, School of Arts, *Boulder, Colorado* 80304

Light scattering experiments supported under GH-34681 will be continued. Laser light scattering experiments will be performed on p- and n-type wide-bandgap semiconductors is very high magnetic fields. Both intravalence band spin-flip and intervalence band spin-flip processes will be examined, with particular emphasis upon spin-flip of photo-injected carriers.

Light scattering studies of phase transitions involving coupled modes will be continued. The Raman and Brillouin spectra of BaMnF4 near its second-order antiferroelectric transition at Tc equal 255K will be investigated. Strong phonon-magnon coupling near T will be characterized in FeC12-2H20. With Brillouin and autocorrelation spectroscopy the linewidth of the central modes in TmVO4, and BaMnF4 and RbCoF3 will be measured.

SUPPORTED BY U.S. Natl. Science Foundation

26.0006, DETERMINATION OF THE CHARGE DISTRIBUTION WITHIN COMPLEX IONS AND RELATIONSHIPS BETWEEN CRYSTAL FORCES AND LATTICE SYMMETRY
J.A. MCGINNETY, Yale University, School of Chemistry, *New Haven, Connecticut* 06520

A quantitative relationship between applied crystal forces and the observed anion bond length distortions has been established for potassium sulphate, potassium chromate, cesium tetrachlorocuprate and related compounds. Parameters derived in the process include the stretching force constant for the bond and the charge distribution within the complex anion. Good agreement between the stretching force constant derived in this way and the analogous parameter derived by normal coordinate analysis of the vibrational spectrum has confirmed the method.

Future work will include the precise determination of structural parameter by x-ray diffraction studies, analysis of the crystal force field to determine the bond stretching force constant and charge distribution by other experimental results if possible, and calculation of the lattice energy both thermodynamically and using the charge distribution derived from the structural analysis. Research originated under GH-39294 will be continued.

SUPPORTED BY U.S. Natl. Science Foundation

26.0007, RESEARCH IN MATERIALS SCIENCE
H. FRITZSCHE, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637

This award provides for the continuation of some of the research previously supported under GH-33636. Work will be continued on selected aspects of the amorphous solids, disordered materials, high pressure- high temperature studies, and a variety of smaller individual research projects.

SUPPORTED BY U.S. Natl. Science Foundation

26.0008, OPTICAL SPECTROSCOPY OF SOLIDS
L.L. CHASE, Indiana University, School of Arts, *Bloomington, Indiana* 47401

Investigations, previously supported by NSF Grant No. GH-33404, on Raman scattering and optical spectroscopy of solids will be continued. Experimental work is in progress and will continue in three areas: (1) Impurity-induced Raman scattering measurements of the vibrational and electronic excitation induced in a crystal lattice by a substitutional impurity having a degenerate ground state which undergoes a Jahn-Teller distortion; (2) Optical Reflectivity and Raman scattering measurements of transition metal oxides; (3) Selective excitation of high-density excitons in wide-band-gap semiconductors using a tunable dye laser.

SUPPORTED BY U.S. Natl. Science Foundation

26.0009, X-RAY STUDIES OF SOLID STATE PROPERTIES
R. COLELLA, Purdue University, School of Science, *Lafayette, Indiana* 47907

Research supported by NSF Grant No. GH-39200 will be continued. X- ray diffraction will be used for valence charge density determinations for various III-V and II-VI crystals, and for thermal diffuse scattering studies in a variety of materials, including metals, metal-oxides and biological crystals. It has been found that only quasi-forbidden reflections with sin / 0.46 are sensitive to asphericity of the valence electrons in preliminary work. It is planned to perform low temperature measurements. Zn-Se and Cd-Te are also considered as suitable candidates, in order to elu-

cidate the relationship between piezoelectric coefficient and valence charge density.

A new method for X-ray diffuse scattering is proposed in which use is made of continuous radiation, so that strings of points lying on radial lines in reciprocal space are explored simultaneously. General points anywhere in the Brillouin zone are utilized, rather than symmetry directions only. Preliminary tests are in progress and the first results are encouraging. Several applications will be tested.

SUPPORTED BY U.S. Natl. Science Foundation

26.0010, MATERIALS RESEARCH LABORATORIES
J.M. HONIG, Purdue University, School of Science, *Lafayette, Indiana* 47907

Core support is provided for materials research in the areas of acoustics in solids, electronic properties of oxides, semiconductors, and surfaces and interfaces. In addition, individual research will be carried out on glasses, quantum transport properties of metals, and selected materials, as will a seed program on natural resources.

Cooperative research is under progressive development, particularly in the first two thrust areas, and further definition of an interdisciplinary involvement in the major research efforts are expected during the coming year. This award is a continuation of GH-33574.

SUPPORTED BY U.S. Natl. Science Foundation

26.0011, CONDUCTION ELECTRONS AND MAGNETISM
R.E. PRANGE, Univ. of Maryland, School of Arts, *College Park, Maryland* 20740

Research, supported by NSF Grant No. GH-39043 on fundamental problem of the electronic structure and thermodynamics of ferromagnetic metals will be continued. At low temperatures and low excitation energies the 3-d magnetic transition metals are well described by standard Stoner-Wohfarth energy band theory including the associated spin waves. Near and above the Curie point, however, and at lower temperatures for some measurements, this simple Stoner picture seems to fail. In particular, the expected collapse of the up- and down-spin bands at the Curie temperature seems to occur in some measurements and not in others.

Recent advances in condensed matter physics will be applied to this problem. Drawing on results from the theory of random alloys, we recognize that split energy bands can remain, near and above the Curie point, even in the absence of long-range order. The band states adiabatically follow the slow fluctuations of magnetization in space and time. Nonequilibrium properties will be studied using the decoupled mode dynamical scaling theory as well as by diagrammatic techniques. Finally, we intend to continue our investigation of ferromagnetic resonance near the Curie temperature, as one important test of the above ideas.

SUPPORTED BY U.S. Natl. Science Foundation

26.0012, TIME DEPENDENT HYPERFINE INTERACTIONS
G.R. HOY, Boston University, Graduate School, *Boston, Massachusetts* 02215

The study of time dependent solid state phenomena using three different experimental procedures begun under NSF Grant No. GH-39137 will be continued. The work on the selective excitation double Mossbauer effect (SEDM) and delayed coincidence Mossbauer spectroscopy (DCMS) will be extended. SEDM is superior to regular Mossbauer techniques for studying relaxation effects. The relaxation time in - Fe2 O3 near the Morin transition has been investigated. The electron hopping model proposed to explain relaxation effects in Magnetite (Fe3 O4) will be tested. DCMS can be used to study directly the time dependence of the nuclear environment. The time dependence of the recoilless fraction, already observed, will be studied. The study of 'after-effects' and perform DCMS using Sn199 will be completed. Finally the building of a He3 - He4 dilution refrigerator Mossbauer system to study electronic relaxation in paramagnetic compounds containing ferric (6S5/2) ions will be finished.

SUPPORTED BY U.S. Natl. Science Foundation

26.0013, SOLIDIFICATION (CRYSTAL GROWTH) IN THE ABSENCE OF GRAVITATIONAL FORCES
H.C. GATOS, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (179-12-14)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

26.0014, THE FUNDAMENTALS AND TECHNOLOGY OF SUPERCONDUCTING TRANSITION METAL ALLOYS WITH EMPHASIS ON THE A15 COMPOUNDS
R.M. ROSE, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139

Description: A direct attack, via the tunneling technique, on the fundamental reasons for the high transition temperatures of the A15 compounds. The latter have the highest known transition temperatures and critical fields, but there is no acceptable explanation for these properties at this time. Because of the technical importance of such properties and the promise of still better properties, the very difficult but promising route of tunneling experiments is being undertaken. Also, the development of materials for practical high-power superconducting microwave cavities is another goal; these materials will probably be ductile solid solutions rather than A15 compounds.

SUPPORTED BY U.S. Dept. of Defense - D.A.R.P.A.

26.0015, ELECTRONIC STRUCTURE AND ELECTRON-NUCLEAR HYPERFINE INTERACTIONS IN SOLID STATE
T.P. DAS, State University of New York, School of Arts, *Albany, New York* 12224

The effort, previously supported by NSF Grant GH-34405, toward a fundamental understanding of the electronic structure and associated properties, optical, magnetic and hyperfine, of metals, alloys and ionic crystals, both perfect and imperfect, by procedures that are as close to first-principle as practicable will be continued. The electronic structure and properties of perfect metals will be studied self- consistently by the Hartree-Fock procedure with correlation included explicitly. These studies will be carried out both because these metals are of basic interest by themselves and also because they provide a starting point for the understanding of imperfect materials like alloys, small particles and surfaces.

SUPPORTED BY U.S. Natl. Science Foundation

26.0016, MAGNETIC RESONANCE PROPERTIES OF IONS IN LIQUID AND SOLID HELIUM
J.F. REICHERT, State University of New York, Graduate School, *Buffalo, New York* 14222

An extension of the research efforts funded by NSF Grant No. GH- 39199 for the study of the magnetic resonance properties of ions in liquid and solid helium will be made. Significant progress has been made over the past months. The spin resonance signal has been detected of the negative ion in liquid helium, its line width measured and the g- value and apparent spin lattice relaxation time estimated. A new and potentially powerful technique for making sensitive measurements of the electron spin polarization of electrons field emitted from metallic tips has been discovered. A variety of experiments to study both the magnetic resonance properties of the ions themselves, as well as the magnetic properties of metals using the electron spin polarization measurements, will be undertaken.

SUPPORTED BY U.S. Natl. Science Foundation

26.0017, VERY HIGHLY SPIN-POLARIZED SYSTEMS
A. HONIG, Syracuse University, Graduate School, *Syracuse, New York* 13210

Research previously supported under GH-35867 will be continued. The principal emphasis of the work is on highly spin-polarized electron and proton systems. In semiconductors such as Ge, GaAs and amorphous Si, electron spin polarization will be studied through optical and photoconductive transport measurements. In HD, proton spin polarization studies will focus on the D relaxation time.

SUPPORTED BY U.S. Natl. Science Foundation

26.0018, TRANSIENT NUCLEAR MAGNETIC RESONANCE STUDY OF SOLIDS
I.J. LOWE, Univ. of Pittsburgh, School of Arts, *Pittsburgh, Pennsylvania* 15213

Research previously supported under GH-32861 will be continued: 1. Zero time resolution (ztr) nuclear magnetic resonance experiments will be continued and applied in particular to the following: (A) Development of the ztr technique further to be useful to study polycrystalline materials. (B) Study of proton positions and motion in Ice I. (C) Study of motional narrowing and diffusion in single crystals of CdF2, PbF2 and LaF3. 2. The spin lattice relaxation times (Tl) of water of hydration in crystals will be studied at very long Tl's to explain the peculiar temperature and field dependence that has been found for gypsum. 3. The protron free induction decay (fid) shape of single crystals of ice doped with HF and paramagnetic ions, kept at helium tempeatures, will be investigated to see if the proton lattice evolves into a lower energy configuration. Spin lattice relaxation time measurements in the laboratory and rotating reference frame will be made on several of the phases of high pressure ice to study motion of the protons in these phases. Proton second moments derived from fid shapes will yield information about the relative positions of the protons in these phases.

SUPPORTED BY U.S. Natl. Science Foundation

26.0019, PROPERTIES OF DILUTE MAGNETIC ALLOYS AT VERY LOW TEMPERATURES AND NUCLEAR COOLING
O.G. SYMKO, Univ. of Utah, School of Letters, *Salt Lake City, Utah* 84112

The experimental study of electronic magnetism and nuclear magnetism in alloys at very low temperatures begun with NSF Grant No. GH-34250 will be continued. For transition metal impurities in a non- magnetic metal host, there are various possible interactions between the impurities and their surroundings. There can be impurity-impurity interactions caused by indirect exchange via the conduction electrons, crystal field effects caused by the splitting of impurity states by the crystalline electric fields of surrounding ions and conduction electrons, and possible single impurity effects causing spin compensation of the impurity spin. To study effects of these interactions and their importance, thermodynamic and transport properties of Au-Fe and Cd-Mn alloys will be measured at temperatures such that kT is of order of the interaction. In particular measurements will be made of the magnetization, electrical resistivity, and thermoelectric power of these alloys in a 3He-4He dilution refrigerator with SQUID magnetometers. The impurity concentration dependence of the above properties will be studied, as well, down to concentration levels of order of 1 ppm. Experiments on adiabatic demagnetization of clear spins in In-Sn alloys, and Au-In2 will be performed in order to improve the techniques of producing submillidegree temperatures. Because of the large cooling power of these alloys, they could be used to cool to submillidegree temperatures other systems such as metals, alloys, and hopefully, liquid 3He.

SUPPORTED BY U.S. Natl. Science Foundation

27. PROPELLANTS

Includes Fuels; Igniters; and Oxidizers. For Basic Research See: 06 Chemistry; and 33 Thermodynamics and Combustion. For Related Information See Also: 28 Propulsion Systems.

27.0001, NEW ORGANOLANTHANIDES AND ORGANOACTINIDES RELATED TO CATALYSIS
M. TSUTSUI, Texas A & M University System, School of Science, *College Station, Texas* 77843 (AF-AFOSR-2017-71)

To meet future propulsion requirements the air force needs research to identify catalysts and fuel additives that substantially reduce ignition delay times in supersonic streams, and to further the development of fuel catalysts which will allow candidate hydrocarbon fuels to meet the cooling and propulsion requirements of missiles and manned recoverable air-breathing engine systems. The major aim of this investigation is the synthesis and characterization of organolanthanides and actinides with new bonding modes. Of specific interest are new species involving covalent bonding between the metal and organic moiety. The chemical and physical properties of these new compounds will be explored. The research includes the synthesis of sigma and pi bonded organolanthanide and actinide f-penetration complexes, structure of organolanthanides and actinides and theoretical study of f-orbital chemistry, and investigation of reactions and catalytic activity of new organolanthanides and actinides.

Supporting agency address information: AF Office of Scientific Research, 1400 Wilson Blvd, Arlington, Va. 22209.

SUPPORTED BY U.S. Dept. of Defense - Air Force

28. PROPULSION SYSTEMS

Includes Air Breathing, Electric, Liquid, Solid, and Magnetohydrodynamic Propulsion. For Nuclear Propulsion See: 22 Nuclear Engineering. For Basic Research See: 23 Physics, General; and 33 Thermodynamics and Combustion. For Applications See: 31 Space Vehicles. For Related Information See Also: 27 Propellants.

28.0001, LOW COST SMALL TURBINE ENGINE COMPONENT DEVELOPMENT
J. LUNNY, Avco Corporation, *Stratford, Connecticut* 06497 (F33615-72-C-1844)

The objective of this effort is to design, develop and demonstrate turbine technology which is considered a critical requirement for a practical low cost, limited life turbine engine.

The results of the low cost, limited life turbine engine analysis program indicated that the turbine and compressor components warrant the most attention in a component development program since they typically comprise 30 to 50 percent of engine cost. The approach taken in this program is comprised of three phases. In Phase 1, a preliminary design based on engine cost tradeoffs will be made for a low cost engine. In Phase 2, a detail design of the compressor will be made based on further cost tradeoffs. In Phase 3, the compressor will be fabricated and tested to determine performance and to demonstrate mechanical integrity.

Supporting agency address information: AF Aero-Propulsion Laboratory, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

28.0002, LOW COST SMALL TURBINE ENGINE COMPONENT DEVELOPMENT
P. MITCHELL, United Aircraft Corporation, *West Palm Beach, Florida* 33402 (F33615-72-C-2177)

The objective of this effort is to design, develop and demonstrate turbine technology which is considered a critical requirement for a practical low cost, limited life turbine engine.

The results of the low cost, limited life turbine engine analysis program indicated that the turbine and compressor components warrant the most attention in a component development program since they typically comprise 30 to 50 percent of engine cost. The approach taken in this program is comprised of three phases. In Phase I, a preliminary design based on engine cost tradeoffs will be made for a low cost engine. In Phase II, a detail design of the turbine will be made based on further cost tradeoffs. In Phase III, the turbine will be fabricated and tested to determine performance and to demonstrate mechanical integrity.

Supporting agency address information: AF Aero-Propulsion Laboratory, Wright-Patterson AFB, Ohio 45433.

SUPPORTED BY U.S. Dept. of Defense - Air Force

28.0003, ENERGY CONVERSION - STUDIES OF TRANSONIC TURBINES WITH FILM-COOLED BLADES
J.F. LOUIS, Mass. Inst. of Technology, Division of Sponsored Res., *Cambridge, Massachusetts* 02139 (N00014-67-A-0204-0079)

The objective of this project is to gather the necessary data essential in developing design procedures for high performance, cooled, highly loaded transonic turbine stages. The effort is theoretical and experimental in nature and is aimed at reducing the amount of cooling required per unit of work extracted. The research will contribute to increased performance of gas-turbine engines needed particularly for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

Study will be made of heat transfer and shock-film interaction in the blade passages in optimizing performance and design and blade passages and secondary flow injection. First year effort will concern theoretical analysis to determine optimum profiles for transonic turbines and a test program to investigate supersonic film flow effects upon film separation. Shadowgraphs will be used for flow visualization.

Supporting agency address information: Office of Naval Research 473, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

29. SPACE RADIATION

Includes Cosmic Radiation; Solar Flares; Solar Radiation; and Van Allen Radiation Belts. For Related Information See Also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

29.0001, MAGNETIC STORMS
C.F. KENNEL, Univ. of California, School of Letters, *Los Angeles, California* 90024

Theoretical investigations will be carried out on a series of problems in the general areas of magnetic substorms and time-dependent magnetospheric configurational changes, ring current and plasmapause dynamics, and magnetosphere-ionosphere interactions. A parallel program of experimental data analysis will be undertaken to investigate solar- wind-magnetic storm correlations, magnetospheric field changes, and wave-particle interactions using already processed data from ground stations and the satellites ATS-1, OGO-5, and Explorers 33 and 35.

SUPPORTED BY U.S. Natl. Science Foundation

29.0002, THIRD SOLAR WIND CONFERENCE
C.T. RUSSELL, Univ. of California, Graduate School, *Los Angeles, California* 90024 (188-36-55)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

29.0003, RADIOWAVE DIAGNOSTIC STUDIES OF THE EARTH'S PLASMA ENVIRONMENT
H.G. BOOKER, Univ. of California, School of Engineering, *San Diego, California* 92038

This grant supports research at an observatory which uses interplanetary scintillations to make daily measurements of the solar wind speed, direction, and the power spectrum of electron density irregularities. The observations will study the effects of co-rotating high velocity streams and transient blast waves caused by solar flares. The observations are not confined to the ecliptic and can be made as close as 1 solar radius from the photosphere. The research continues the regular observations and uses them to study the structure of co- rotating and transient events; relates these structures to photospheric structures; and studies the average or quiescent properties of the solar wind, particularly out of the ecliptic plane. Observations of the microstructure spectrum will be used to search for the signature of various plasma instabilities.

SUPPORTED BY U.S. Natl. Science Foundation

29.0004, NAVY ENVIRONMENT - HIGH ALTITUDE RESEARCH USING BALLOON VEHICLES
D.R. WILLIAMS, Winzen Research Incorporated, *Minneapolis, Minnesota* 55420 (N00014-72-C-0401)

This work relates to improving the Navy's operational capabilities in communications, detection and weapons delivery systems by developing a better understanding of the transformation processes of high-energy solar, galactic and cosmic particles continuously entering the earth's environment.

The Skyhook Balloon Program provides balloon vehicles of the most reliable type for various scientists desiring to measure time fluctuations and energy spectra of cosmic rays, proton and electron flux, primary gamma rays, high charge nuclei, primary electrons and electron precipitation at stratospheric levels. Balloon performance is continuously evaluated in order to increase altitude and payload capability and improve performance reliability.

Supporting agency address information: Office of Naval Research, 421 Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

29.0005, COSMIC RAYS IN INTERPLANETARY SPACE
UNKNOWN, State University of New York, Graduate School, *Stony Brook, New York* 11790 (385-46-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30. SPACE SCIENCES

Includes Astronomy and Astrophysics; Cosmology; Lunar and Planetary Flight and Exploration; and Theoretical Analysis of Orbits and Trajectories. For Related Information See Also: 11 Facilities. Research and Support; and 31 Space Vehicles.

30.0001, AN INVESTIGATION OF ELECTROMAGNETIC PROCESSES IN THE EARLY SOLAR SYSTEM WITH BEARING ON THERMAL EVOLUTION AND FOSSIL MAGNETISM
C.P. SONETT, Univ. of Arizona, Graduate School, *Tucson, Arizona* 85721 (185-50-81)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0002, MICROMETER MEASURES OF CLOSE DOUBLE-STARS, AT LICK OBSERVATORY, UNIVERSITY OF CALIFORNIA
F. HOLDEN, Unknown Inst. or Indiv. Grant, *California*

Renewal for a second year will permit continuation of measures of close visual double star pairs, mainly with separations under two seconds of arc. Observations will be made with the Lick Observatory 36- inch and 12-inch refractors and, at CTIO in Chile, with the 40-inch and 36-inch reflectors. Observing time at other observatories may be requested during the winter months when the seeing is somewhat inferior at Lick.

SUPPORTED BY U.S. Natl. Science Foundation

30.0003, SEARCH FOR EXTREME ULTRAVIOLET RADIATION FROM CELESTIAL OBSERVATIONS ON THE APOLLO SOYUZ SPACECRAFT
C.S. BOWYER, Univ. of California, School of Letters, *Berkeley, California* 94720 (966-30-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0004, THEORETICAL X-RAY AND GAMMA-RAY ASTRONOMY
J.I. SILK, Univ. of California, School of Letters, *Berkeley, California* 94720 (188-41-59)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0005, PIONEER F/G DATA ANALYSIS
D.S. INTRILIGATOR, Univ. of Southern California, School of Letters, *Los Angeles, California* 90007 (811-22-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0006, VIKING 75 ORBITER
M.H. CARR, U.S. Dept. of the Interior, Geological Survey, *Menlo Park, California* 94025

The purpose of the project is to extend our geologic understanding of Mars by aquiring additional high resolution photography of the planet. The project involves assessing the objectives of the on-going Mars exploration program and determining how the capability of the Viking Orbiter cameras can be utilized to realize these objectives. The design of the Orbiter camera,

the development of the ground operation system and integration with the rest of the Viking project are all being followed to ensure maximum scientific return from the experiment. The present plan is to launch the Viking spacecraft in 1975. The main data- taking period will be from July to November 1976.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

30.0007, CRATER EJECTA STUDIES
H.J. MOORE, U.S. Dept. of the Interior, Geological Survey, *Menlo Park, California* 94025

Study of ejecta from lunar craters as a function of their size.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

30.0008, SELECTED X-RAY STUDIES TO BE PERFORMED USING DATA FROM THE UHURU (SAS-A) SATELLITE
G.P. GARMIRE, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (385-41-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0009, CIRCULATION OF THE SOLAR ATMOSPHERE
H. ZIRIN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109

This grant supports the program of solar research carried out by Caltech Solar Astronomy Group, including the observational programs at the Big Bear Solar Observatory and the operation of the Tel Aviv photoeliograph. Specific research is: 1) Obtaining the highest possible resolution photographs and spectrograms of the solar atmosphere with the 26-inch and 10-inch telescopes at the Big Bear Solar Observatory. 2) A program of solar monitoring using the full disc telescope at Big Bear and the small photoeliograph at Tel Aviv. 3) Studies of solar magnetic fields determined by the filter video magnetograph and by the interpretation of the chromospheric structure as seen in normal filtergrams. 4) Studies of the physics of solar flares through connection of optical features with x-ray and radio emission, as well as observations of magnetic phenomena associated with flares. 5) Spectroscopy of solar phenomena, in particular solar flares, prominances, sunspots and the five minute oscillation. 6) Theoretical analysis of wave phenomena in the solar atmosphere and interpretation of observations of such phenomena. 7) Training of undergraduate and graduate students in the carrying out of solar observations. 8) Support of other observatories with filtergrams and films.

SUPPORTED BY U.S. Natl. Science Foundation

30.0010, SUMMER WORKSHOP ON CRITICAL PROBLEMS IN PHYSICS AND ASTROPHYSICS
D. PINES, Aspen Center For Physics, *Aspen, Colorado* 81611

The Aspen Center for Physics brings together physicists and astrophysicists (mostly theorists) for informal interchange of ideas (both within one discipline and across disciplinary lines), for the pursuit of individual research in a stimulating atmosphere, and for joint attack on particularly important and interesting problems. The topics to be jointly studied by members of informal working groups include: 1. Physics of galaxies; 2. Dual Resonance Models; 3. Very High Energy Hadronic Interactions; 4. Unified Field Theories of Hadrons and Leptons; 5. Biophysics; 6. Mathematical Physics.

SUPPORTED BY U.S. Natl. Science Foundation

30.0011, THERMAL STATISTICS OF THE SOLAR CORONA
D.E. BILLINGS, Univ. of Colorado, School of Arts, *Boulder, Colorado* 80304

This grant extends the program now underway of deriving a statistical description of the thermal structure in various parts of the inner solar corona, obtaining maximum refinement in the evaluation of the parameters for such a description, and finding the association of these parameters with various aspects of solar activity.

SUPPORTED BY U.S. Natl. Science Foundation

30.0012, DEVELOPMENT OF MODELS FOR PHYSICAL PROPERTIES OF STELLAR CHROMOSPHERES
J.L. LINSKY, Univ. of Colorado, School of Arts, *Boulder, Colorado* 80304 (385-41-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0013, PHYSICAL PROPERTIES OF CHROMOSPHERIC ACTIVE AND QUIET REGIONS BY THE ANALYSIS OF EXISTING OSO-4 AND OSO-6 EUV DATA
J.L. LINSKY, Univ. of Colorado, School of Arts, *Boulder, Colorado* 80304 (385-38-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0014, APPLIED MATHEMATICS
C. HUNTER, Florida State University, School of Arts, *Tallahassee, Florida* 32306

This is the first year support of a continuing grant for research previously provided under grant GP 30136.

C. Hunter will continue his work in two major areas. The first is that of the properties of patterns of waves. In many physical problems in which waves occur, the generating source excites a variety of waves with a range of frequencies. It is therefore important to study how the individual waves combine to form patterns, and, in particular, to determine what are the most prominent features of the pattern. Specific applications of the general methods are to be made to several problems associated with waves in galactic disks that are relevant to the explanation of spiral arms as waves.

The second major area is that of the basic structure of galaxies, viewed as isolated stellar systems. He will construct collisionless stellar models of elliptical and barred galaxies, and to investigate their dynamics. Research will also be directed at the fundamental problems of the statistical mechanics of stellar systems.

SUPPORTED BY U.S. Natl. Science Foundation

30.0015, FAR-ULTRAVIOLET OBSERVATIONS OF COOL STARS WITH THE COPERNICUS SATELLITE
H.W. MOOS, Johns Hopkins University, School of Arts, *Baltimore, Maryland* 21218 (831-43-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0016, METER-WAVE RADIO ASTRONOMY PROGRAM
G.R. HUGUENIN, Univ. of Massachusetts, School of Arts, *Amherst, Massachusetts* 01002

Pulsar observational data obtained at the National Radio Astronomical Observatory (NRAO) will be analyzed to determine the effects of interstellar scintillation upon the pulsar signals. Pulse shapes and dispersions, polarization of individual pulses, and pulsar positions and periods will be determined, also. Theoretical work to devise pulsar models will be based upon the extensive observational data previously obtained, plus new material yet to be secured at NRAW. Long time-scale monitoring of the pulsars will be done at the Five College Radio Astronomical Observatory.

This program is a renewal of the research shared under NSF grant GP-28255.

SUPPORTED BY U.S. Natl. Science Foundation

30.0017, RADAR TESTS OF GENERAL RELATIVITY
G.H. PETTENGILL, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139

Research supported under grant GP-37107 will continue. This research effort in experimental relativity will concentrate on the analysis of passive radar ranging data on the inner planets to determine: 1. The degree of constancy of the gravitational

'constant'; 2. The precise retardation of the travel times of electromagnetic signals passing near the sun; 3. The amount of non-Newtonian advances of the perihelia of the inner planets.

SUPPORTED BY U.S. Natl. Science Foundation

30.0018, IMP-6 SOLAR RADIO BURST ANALYSIS
F.T. HADDOCK, Univ. of Michigan, School of Arts, *Ann Arbor, Michigan* 48104 (385-38-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0019, THEORETICAL PLANETARY PHYSICS
R.E. DANIELSON, Princeton University, Graduate School, *Princeton, New Jersey* 08540

Under a second year of support the group will concentrate on theoretical research in two detailed areas: 1) Solar energy deposition in the atmospheres of the Major Planets, particularly Uranus and Neptune, and 2) The physics of the absorbing particles causing the blue and ultraviolet absorption in the atmospheres of Titan and the Major Planets. In addition, it is proposed to complete the reduction of planetary photometry obtained by OAO-A2.

Prior support was by NSF grant GP-39055.

SUPPORTED BY U.S. Natl. Science Foundation

30.0020, ECONOMIC ANALYSIS OF SOLAR SYSTEM EXPLORATION SPACE MISSIONS
J.P. LAYTON, Princeton University, School of Engineering, *Princeton, New Jersey* 08540 (684-89-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0021, DATA ANALYSIS OF SO73 GEGENSCHEIN/ZODIACAL LIGHT EXPERIMENT
J.L. WEINBERG, State University of New York, Graduate School, *Albany, New York* 12203 (948-70-70)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0022, DYNAMICS OF PLANETARY ATMOSPHERES
P.J. GIERASCH, Cornell University, School of Arts, *Ithaca, New York* 14850

The purpose of this research program is to study the circulation of the atmosphere of Venus with emphasis on the role of three dimensional flow effects. The thermal structure of the Venus stratosphere will be investigated by means of simple radiative-dynamical models. The possibility of a strong circumpolar vortex over the Martian winter pole will be investigated. Models of the large scale flow in the solar convection zone will be developed, with particular attention to boundary conditions and time dependence.

SUPPORTED BY U.S. Natl. Science Foundation

30.0023, ANALYSIS AND INTERPRETATION OF ROCKET X-RAY POLARIMETRIC DATA FOR SOLAR X-RAY ASTRONOMY
R. NOVICK, Columbia University, School of Arts, *New York, New York* 10027 (385-38-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0024, THEORETICAL ASTROPHYSICS
M.A. RUDERMAN, Columbia University, School of Arts, *New York, New York* 10027

Research supported under NSF grant GP-18062 will be continued. Specific topics in the broad area of theoretical astrophysics include: (1) X-Rays from galactic clusters. (2) Properties and effects of neutron star surfaces. (3) Dynamics of pulsers. (4) Relativistic transport theory. (5) Consequences of Weber's experiment. (6) Extragalactic rings. (7) Convection theory. (8) Solar rotation. (9) Magnetic white dwarfs. (10) Maser action in HII regions.

SUPPORTED BY U.S. Natl. Science Foundation

30.0025, PHYSICAL PROPERTIES OF MOLECULAR CLOUDS
A.E. GLASSGOLD, New York University, School of Arts, *New York, New York* 10003 (188-41-51)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0026, OBSERVATIONS OF COMET KOHOUTEK AT FAR INFRARED AND SUBMILLIMETER WAVELENGTHS
M. SIMON, State University of New York, School of Arts, *Stony Brook, New York* 11790 (196-41-53)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0027, NUCLEAR ASTROPHYSICS - EXPERIMENTAL AND THEORETICAL
C.N. DAVIDS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712

The research conducted under this grant will focus on nuclear states and reactions that are of particular interest to astrophysics. It will be a direct continuation of the first rate work that has gone on over the past few years.

This work is a continuation of that currently supported by Foundation grant GP-23282.

SUPPORTED BY U.S. Natl. Science Foundation

30.0028, ATLAS OF MARINER 9 ALBEDO CHARTS OF MARS
G.H. DEVAUCOULEURS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (384-50-80)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0029, PRECISION ORBIT DETERMINATION FOR NEAR-EARTH SATELLITES
B.D. JAPLEY, Univ. of Texas, Graduate School, *Austin, Texas* 78712 (161-02-02)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0030, ANALYSIS OF COPERNICUS OAO11 DATA ON THE MG 11 RESONANCE DOUBLET AT 2802 AND 2795A, IN EARLY TYPE STARS
J.L. MODISETTE, Houston Baptist College, Undergraduate School, *Houston, Texas* 77036 (831-43-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0031, STUDIES OF LUNAR MAGNETISM AND INTERPLANETARY PLASMA DISCONTINUITIES
D.E. JONES, Brigham Young University, School of Physical Sciences, *Provo, Utah* 84601 (914-40-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

30.0032, PARALLAXES AND PROPER MOTIONS OF SELECTED STARS
L.W. FREDRICK, Univ. of Virginia, School of Arts, *Charlottesville, Virginia* 22903

A renewal grant for one year continues partial support for the Leander McCormick Observatory program to obtain paral-

laxes and proper motions of late-type stars selected mainly from the Vyssotsky list. A significant sub-program is that for Hyades stars as part of an international effort. All regions measured contain two parallax stars, one the star in interest and the other a control star. UBV photometry of all program and reference stars is carried out. The new 40-inch astrometric reflector will be brought into full use.

Prior support was by NSF grant GP-25090.

SUPPORTED BY U.S. Natl. Science Foundation

31. SPACE VEHICLES

Includes Launch Vehicles; Manned Space Capsules; Clustered and Multistage Rockets; Satellites; Sounding Rockets and Probes; and Operating Problems. For Basic Research See: 30 Space Sciences. For Related Information See Also: 28 Propulsion Systems; and 32 Structural Mechanics.

31.0001, ANALYTICAL EXPRESSIONS OF RADAR CROSS-SECTION OF TARGETS AND MODELING OF SPACE SHUTTLE CANDIDATE TARGETS

M.S. SOHEL, Texas A & M University System, Graduate School, *Prairie View, Texas* 77445 (340-00-00)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

32. STRUCTURAL MECHANICS

Includes Structural Element Design and Weight Analysis; Fatigue; Thermal Stress; Impact Phenomena; Vibration; Flutter; Inflatable Structures; and Structural Tests. For Related Information See Also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

32.0001, NAVY VEHICLES - ACOUSTIC EMISSION DETECTION RELATED TO NONDESTRUCTIVE DETECTION

R. STERN, Univ. of California, School of Engineering, *Los Angeles, California* 90024 (N00014-69-A-0200-4031)

The objective is the development of improved acoustic methods for detecting impending structural failure in navy ships and aircraft and improved design capabilities for navy vehicles. The work uses acoustic emission detection in nondestructive testing applications aimed at in- situ monitoring of acoustic emissions in operation conditions for antisubmarine vehicles.

Acoustic emission resulting from elastic deformation, plastic deformation, or microcrack formation is examined for rate of pulse generation, pulse shape, frequency spectra, and pulse intensity in order to identify sources of emission, location of source, propagation path and mode of propagation. The goals are analysis of microstructure, identification of size and shape of microcrack formation and mode of propagation by passive acoustic signal analysis in solids.

Supporting agency address information: Office of Naval Research 468, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

32.0002, SEVENTH U.S. NATIONAL CONGRESS OF APPLIED MECHANICS

F. ESSENBURG, Univ. of Colorado, School of Engineering, *Boulder, Colorado* 80302 (501-21-21)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

33. THERMODYNAMICS AND COMBUSTION

Includes Ablation, Cooling, Heating, Heat Transfer, Thermal Balance, and Other Thermal Effects; and Combustion Theory. For Related Information See Also: 12 Fluid Mechanics; and 27 Propellants.

33.0001, INVESTIGATION OF FACTORS AFFECTING THE HEAT TRANSFER TO TURBINE ENDWALLS

R.E. OLSON, United Aircraft Corporation, *Hartford, Connecticut* 06118 (N00019-72-C-0365)

To study the factors affecting the heat transfer to turbine endwalls.

Critical heat transfer areas on the endwall of a typical high temperature turbine vane passage will be identified in wind tunnel experiments. Data will be used for the development of improved methods for estimating endwall heat transfer loads.

Supporting agency address information: Naval Air Systems Command, 310 Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

33.0002, EMISSIONS FROM HIGH INLET TEMPERATURE GAS TURBINES

A.M. MELLOR, Purdue University, School of Mechanical Engin., *Lafayette, Indiana* 47907 (72P00493)

In an experimental facility for basic gas turbine combustor emissions research, detailed internal measurements are made within a combustor so that those zones responsible for the formation and destruction of unburned hydrocarbons, CO, NO, and NO2 can be determined. Thus the influence of combustor design on emissions can be ascertained. Realistic aircraft and automotive gas turbine conditions can both be simulated, and thus both characterization of turbine engine exhaust emissions and development of a better understanding of the processes responsible for emissions in actual combustors can be accomplished under realistic conditions.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

33.0003, HYPERSONIC LOW DENSITY FLOW RESEARCH

J.A. SMITH, Princeton University, School of Engineering, *Princeton, New Jersey* 08540

Heat transfer rates to a 10 degree half angle cone under various free stream and yawed conditions will be measured using the thin film resistance thermometer technique. By using this method, the mean free path of free stream molecules traveling in a cloud of body emitted molecules as well as the mean free path between collisions of body emitted molecules, can then be determined.

SUPPORTED BY U.S. Natl. Science Foundation

34. GENERAL

Includes Information of A Broad Nature Related to Industrial Applications and Technology, and to Basic Research; Defense Aspects; Information Retrieval; Management; Law and Related Legal Matters; and Legislative Hearings and Documents.

34.0001, CONTROL OF MULTI-TERMINAL HIGH VOLTAGE DIRECT CURRENT (HVDC) POWER SYSTEMS

D.P. CARROLL, Purdue University, School of Electrical Engin., *Lafayette, Indiana* 47907

This project is a continuation of research on the control of multiterminal HVDC power systems. With the development and construction of several HVDC portions of Electric Power Transmission networks there is a need to develop control strategies which will operate and control these Power Systems with maximum efficiency and reliability. This investigation considers the interaction of circuit breaker operations and converter control techniques for multiterminal HVDC power system with various circuit breaker configurations. Hybrid and analog models which were developed during the first year will be used and expanded for the next year's efforts.

SUPPORTED BY U.S. Natl. Science Foundation

34.0002, APPLIED STUDIES ON ADVANCED BOILER TECHNOLOGY FOR AUTOMOTIVE RANKINE CYCLE ENGINES

F.W. PAUL, Carnegie Mellon University, School of Engineering, *Pittsburgh, Pennsylvania* 15213 (72P20744)

This research is directed toward the applied physical understanding of the thermal-hydraulic behavior of advanced Rankine Cycle Engine boilers. The objectives of the research are to evaluate the current state-of-the-art of advanced boiler technology, to select the 'best' design concept, and to develop experimental data and analytic models useful for the design of the boiler in two-phase-flow for Rankine Cycle Automobile Engines. Steady-state pressure drop, heat transfer coefficients and geometric stu-

dies shall be made as well as transient- state studies for lumped parameter modeling of the boiler.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.M.

34.0003, ENERGY SYSTEMS STUDIES

R. CARLSMITH, Oak Ridge National Laboratory, *Oak Ridge, Tennessee* 37830

This is a one-year research program entitled, 'Impact of Environmental Controls on Coal Supply and Price,' (Task 1 of 'Energy Conservation and the Environment'). The program encompasses a detailed and systematic analysis of the opportunities for expanding the nation's coal supply.

The work in FY '74 is divided into several related tasks. In the first task, they will assemble detailed technical descriptions of the engineering relationships of coal mining technology, both current and emerging. Much of this information will be obtained under a subconstructural arrangement with a mining engineering consultant firm. The second task involves the preparation of estimates of the future cost and availability of the inputs (labor, equipment) required for coal production. The output of this and the previous task will then be combined to construct a linear programming process analysis model which can simulate the technological and economic relationships which determine coal productions.

In the third task, they will apply the model to prepare forecasts of U.S. coal supplies by producing region for the years 1980 and 1985. The model will be used to see if the current projections which call for a doubling of coal output by 1985 are actually attainable, and to identify those factors which may constrain such an expansion. They also will evaluate the various policy options (regulations, subsidies, etc.) which might be used to alleviate the effects of the potential constraints.

SUPPORTED BY U.S. Natl. Science Foundation

34.0004, HYDROGEN FUEL SYSTEMS

R.B. CAIRNS, Boeing Company, *Seattle, Washington* 98124

Description: Investigation of potential use of aerospace technology in production, storage and distribution of hydrogen as a fuel for commercial, industrial transportation or residential use.

SUPPORTED BY Boeing Company - Seattle, Wash.